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MINISTRY OF RAILWAYS

(Railway Board)

RESOLUTION

(No. 6206-TT)

New Delhi, the 19th January, 1957.

S.R.O. 263.—In continuation of Notification No. E(AO)56API-7, dated 30th November, 1956, published in Part II, Section 3 of the Government of India Gazette of 1st December, 1956, the Government have now received the Report submitted by Shri Himansu Kumar Bose, a Judge of the High Court at Calcutta, on the causes of accident to Train No. 603 Tuticorin Express at Mile 170/14-12 between Ariyalur and Kallagam on the Villupuram-Trichinopoly (Chord) line section of the Southern Railway at 5.30 A.M. on the 23rd November, 1956, and hereby publish it for general information. The Government have accepted the finding and will, after due consideration, take such action as may be necessary on the various matters brought out in the Report.

D. C. BAIJAL,

Secretary.

JUDICIAL ENQUIRY INTO THE ACCIDENT TO 603 MADRAS—TUTICORIN EXPRESS ON 23RD NOVEMBER 1956—

REPORT

By a Notification of the Government of India, Ministry of Railways (Railway Board) bearing No. E (AO) 56 AP 1-7, dated the 30th November 1956, and published in Part II Section 3 of the Government of India Gazette of 1st December 1956 the Central Government notified as follows:—

> "Whereas the Central Government is of opinion that it is necessary to appoint a Commission of Inquiry for the purpose of making an Inquiry into the causes of the accident to Train No. 603 Tuticorin Express at Mile 170/14-12 between Ariyalur and Kallagam on the Villupuram—Trichinopoly (Chord) line of the Southern Railway at 5.30 hours on the 23rd November 1956;

Now therefore, in exercise of the powers conferred by Section 3 of the Commissions of Inquiry Act 1952 (60 of 1952) the Central Government hereby appoints a Commission of Inquiry consisting of Shri Himansu Kumar Bose, a judge of the High Court at Calcutta, as its sole member.

2. The Said Commission shall:—

(i) make an inquiry into the causes of the said accident and for that purpose take such evidence as may be necessary;

(ii) state its findings as to causes of the said accident and as to the person or persons if any, responsible therefor; and

(iii) suggest safeguards against similar accidents in future.

3. The said Commission shall submit its report to the Central Government within a period of two months from the date on which it commences its enquiry.

D. C. BAIJAL,
Secretary, Railway Board."

On the 1st December 1956 another Notification bearing No. E (AO) 56 AP 1-7 and dated 1st December 1956 was also published in the Government of India Gazette Part II Section 3. The said Notification ran as follows:—

"In exercise of the powers conferred by rule 3 of the Commission of Inquiry (Assessors) Rule 1954, the Central Government hereby appoints the undermentioned persons as Assessors to assist and advise the Commission appointed by the Notification of the Central Government in the Ministry of Railways, No. E (AO) 56 AP 1-7, dated 30th November 1956, in respect of any matter connected with the Inquiry to be made by the Commission:—

(1) Shri A. R. Venkatacharya, Retired Chief Engineer, Public Works department, Madras Government.

(2) Shri P. C. Khanna, Retired Chief Engineer, Indian Railways.

D. C. BAIJAL,
Secretary, Railway Board."

On the 9th December 1956 I arrived at Madras from Calcutta, and held certain discussions about the venue of the Inquiry and other matters and on the 10th December 1956 a Notice as drafted and issued by the Commission was published in certain newspapers, published in English and vernacular languages, inviting all those members or representative sections of the public who wished to take part in the Enquiry, to submit their Statements of Case and the names, designation and addresses of the witnesses whom they wanted to examine in support of their case by the 12th December 1956 to the Commission of Inquiry which had decided to hold its sittings for such Inquiry in the High Court buildings in the city of Madras, from 13th December 1956.

In the evening of the 10th December 1956 I left Madras for Trichinopoly and arrived at Trichinopoly station the next morning. The two assessors Sri Venkatacharya and Sri Khanna, the Government pleader Mr. C. A. Vaidyalingam, Mr. V. T. Rangaswami Iyengar, the counsel representing the Railway, Mr. N. K. Roy, Additional Member (Works) Railway Board, and Mr. T. A. Joseph the General Manager of the Southern Railway had also arrived in Trichinopoly at or about the same time from Madras.

Within a few minutes after our arrival we all proceeded to the site of the Accident in a Rail Car which was provided by the Southern Railway. Mr. R. S. Malayappan, the Collector of Tiruchirappalli, (Trichinopoly) also accompanied our party.

At the site of the accident, a detailed inspection was made of the bridge No. 252 and its embankment and/or abutments and also portions of the area under and around the bridge and an inspection was also made of the Marudayar river and portions of its banks in order to form an idea of the course of the river and the rate of flow at the time of the accident. Certain wreckages of the ill-fated train including the Engine and its tender which were still lying there were also seen and certain photographs taken by the Railway authorities immediately after the accident were also brought to our notice. The mark of high flood water level in November 1937 could be seen at about one foot nine inches below the bottom of the girder of the bridge, on the northern abutment of the bridge.

After inspection of the actual site of the accident was completed, we motored down a distance of about four miles on the Ariyalur Tiruchi Trunk Road to inspect the Road bridge which is known as the Rava Panagal bridge on the same river Marudayar. We found that two piers towards the northern side of the bridge had been washed away by the flood and the bridge had collapsed to a length of about 100 feet, and a new temporary causeway had been laid to divert the traffic on the route. It was also noticed that portions of the road near the road bridge had been eroded by water of the river and the flood covering the neighbouring areas.

After the inspection of the road bridge was over we returned to the Ariyalur Station and after a short while we proceeded to inspect the catchment area of the Marudayar river. We covered an area of about fourteen miles of the country road on three Jeep cars provided by the Government of Madras, to get an idea of the extent of the flood in the river on the night of the accident. We passed by several tanks in some of which there were breaches, crossed some tributaries of the river Marudayar, and stopped at certain villages. At a village known as Illupaikadu quite a crowd of villagers assembled near our jeeps and on being interrogated by Mr. Malayappan the Collector, of Tiruchi, about the recent flood, an old woman and some of the other villagers stated that they had never seen such a terrible flood before. As these villagers spoke in their native tongue which was not intelligible to me, Mr. Malayappan interpreted their statements to me. We saw some huts which had been destroyed by the flood.

We started from Trichinopoly at about 9 A.M. for the site of the accident and we returned to Trichinopoly at about 6.30 P.M. after completing our work of inspection.

The accident in question took place at 5.29 hours on 23rd November 1956 when the train No. 603 (Madras-Tuticorin Express) was running between Ariyalur and Kallagam stations in the Villupuram-Trichinopoly Chord Line. Immediately after crossing the bridge No. 252 at mile 170/10-14, which consisted of eight spans of 62'-3" girders, the Engine Y. P. 2069 of the train plunged into a breach of about 70 feet long just behind the Kallagam end abutment of the bridge, caused by heavy floods in the Marudayar river eroding the earth under the railway track. The Engine sank deep into the loose earth and lay capsized slightly inclined towards the right. The pony wheels and the footplate were about 8 feet below the rail level. The tender of the Engine had crashed into the Engine and turned upwards at right angle with its rear end pointing to the sky. The next six carriages got telescoped into one another and some of them were smashed to smithereens. The wreckage was submerged under the swollen waters of the river. The seventh carriage was standing capsized, with its leading end down in the scoured bed on the right and submerged in water and its rear end standing on the last span of the bridge. The eighth carriage was standing upright on the bridge with its leading bogie wheels derailed to the left. The remaining four carriages were in tact on the track.

There were about 360 passengers in the train at the time of the accident some of whom died on the spot and some others died later on. The total death roll, as far as it has been ascertained, was 154. The persons who have escaped with injuries were 114 in number.

The Bridge No. 252 on the Marudayar river was completed in 1928 when the Villupuram-Trichinopoly line was constructed. The construction work of the Bridge was done by Messrs. Braithwaite & Co. Ltd., of Bombay. The bridge, as already stated, rests on eight spans of 62 ft. 3 inches girders supported on cross girder stools over two cast iron screw piles of three feet diameter under each pier and abutment. They were sunk to an overall depth of 65 ft. under all piers and abutments except the one on the Ariyalur side which is 55 ft. deep.

The abutments consist of U shaped R.C.C. Boxes with return walls and cross ties resting upon cast iron piles at the front and teak wood piles at the rear. The earth slopes on the front and side walls of the R.C.C. Boxes are protected by dry stone revetment or pitching up to a length of 20 ft. from the face walls of the abutments and up to a height of 12 ft. from the river bed. It appears that in the year 1942 a guide bund or groyne 110 feet long with stone rivetment pitching on both slopes was provided on the upstream side of the North (*i.e.*, Ariyalur side) abutment to prevent further erosion of the river bank at that end.

In November 1937 the highest flood level recorded at this bridge was approximately 1 ft. 9 inches below the bottom of the girders.

The formation of approach banks is made up of sandy clay. The height of the bank is 16 feet at the Ariyalur end and 11 feet at the Kallagam end.

Between Ariyalur and the site of the accident the railway track falls towards the bridge at a gradient varying from 1 in 200 to 1 in 250 for a train going from Madras; but the track is level on the bridge and over a distance of 800 feet on the Ariyalur side and 850 feet on the Trichinopoly side beyond the abutments.

The maximum permissible speed on this section (as in the entire metre gauge section) is 40 miles per hour. There was no temporary speed restriction in force at this bridge.

The general direction of the railway line between Ariyalur and Kallagam is from north to south but at the actual site of the accident the line runs from North East to South West.

The Marudayar river has its source about 18 miles to the west of the railway line in Perambalur hills which are small hills having a height of 1,000 or 1,500 feet. The total catchment area up to the bridge is approximately 150 square miles and it stretches over undulating country. The Marudayar river crosses the railway line at right angles to the bridge but there are two sharp bends on the up stream side within a length of one mile.

The river bed consists of sand with a deposit of silt at the Trichinopoly side while it consists of clay at the Ariyalur side. The important thing to note however is that the last three spans of the bridge at the Trichinopoly end are silted up to a certain depth. This might have had some effect on the erosion of the southern embankment of the bridge caused by the flood on the night of the accident.

On the 13th December 1956 the first sitting of the Inquiry was held in the 7th Court Room of the Madras High Court building, at 10-30 A.M. and this sitting lasted for only about 40 minutes. Certain directions were given as to the filing of the Statements of Case and the list of witnesses by the Railway Administration and parties who wanted to intervene in the proceedings. The Railway Administration had already prepared its Statement of the Case and they filed the Statement then and there. Some members of the public represented before the Commission that the time given by the Notification published on the 10th December 1956 was short and so it was not possible for them to prepare their Statements of the Case or to submit their lists of witnesses. Some of these representations came in the form of letters addressed to the Commission by certain individuals and Associations and Mr. Ramaswami Aiyar, Advocate, who had been requested by the Madras Advocates' Association to intervene in the proceeding and who appeared at the sitting also asked for further time to submit a statement of case and a list of witnesses. In the circumstances the Commission thought fit to postpone the further sittings till 17th December 1956.

It appears from the Statement of the Case filed by the Railway Administration that the ill-fated train No. 603 (Madras-Tuticorin Express) was running one hour and twenty-one minutes late when it left the Ariyalur station for Kallagam.

It also appears from the said Statement that during the night of 22/23rd November 1956 six trains ran on the Ariyalur-Kallagam Section but the crew of none of the trains had reported that there was anything abnormal or unusual either at Bridge No. 252 or its approaches.

The trains were the following:—

	Hours
1. No. 607 Dhanuskodi Passenger:—	
Ariyalur Dep.	22.28
Kallagam Arr.	22.48
2. No. 604 Tuticorin-Madras Express:—	
Kallagam Dep.	23.46
Ariyalur Arr.	0.02
3. No. 606 Trivandrum-Madras Express:—	
Kallagam Dep.	00.19
Ariyalur Arr.	00.40
4. No. 619 Madras-Tinnevelly Express:—	
Ariyalur Dep.	2.16
Kallagam Arr.	2.36
5. No. 620 Tinnevelly-Madras Express:—	
Kallagam Dep.	2.46
Ariyalur Arr.	3.01
6. No. 605 Madras-Trivandrum Express:—	
Ariyalur Dep.	3.03
Kallagam Arr.	3.24

The further case of the Railway Administration as set out in this Statement of Case and which has a material bearing on the subject matter of the Inquiry is that the catchment area of the river Marudayar, for its major portion, is covered with vegetation and cultivation except at its higher region above the valley where it is comparatively bare. The soil structure varies from a mixture of gravel and clay or gypsum to one of clay and sand. There are several irrigation tanks in the catchment area of which nine are big and fall in the category of railway affecting tanks. It is stated that the maximum flood discharge as calculated by applying the Ryve's formula is 12,647 Cusecs (*i.e.* cubic feet per second), while applying the Kutter's formula it comes to 10,011 Cusecs and velocity of 4·6 per second. Therefore inasmuch as a clearance of 3·9 feet was kept between the observed highest flood level of 194·38 feet and the bottom of the girders as an allowance for the passing of abnormal floods, exceptional floods up to an extent of 31,812 could pass under the bridge in the opening provided.

In 1937 the water level rose to 196·42 and is estimated to have passed a discharge of 16,000 Cusecs through the bridge. There was no damage although the flood is reported to have overtopped the river bank to an extent of 3 ft. or so in the bend upstream and the overflow had hit the railway bank. But still stone pitching up to a height of 4 ft. was provided in 1942.

Further, as the river bed all these years pressed towards the Madras side, scouring its left bank, in 1942-43 a Guide bund (groyne) 70 feet long was built as a protection against this scour, on the left bank.

It is further pointed out in the Statement of Case that the maximum rainfalls at Ariyalur as recorded in previous years were 4·32 inches in 1930, 4·35 in 1933, 6·06 in 1936, 5·16 (10-8-1937) and 4·72 (15-11-1937) in 1937, 5·07 in 1941, 4·97 in 1943, 4·95 in 1951, 7·40 in 1955 and consequently the rainfall of 3·75 on 20-11-1956, and 23-11-1956 on the date of the accident was not uncommon for the basin and so it was a combination of unusual circumstances that led to the abnormal and unpredictable floods on 23-11-1956.

The peak flood discharge, according to the railway on the night of 22nd/23rd November 1956 can be estimated to have been of the magnitude of about 50,000 Cusecs at the Railway bridge. The water level rose above the bottom of the girders and due to this there was a heading up with consequent high velocity under the bridge. Added to this the water from the overflow of the bank coming cross country flowed by the side of the Trichinopoly approach bank, went through the bridge, joining the main stream in the last span No. 8. There were swirls created as a result of which there was good deal of scouring in spans 8 and 7 and this damaged the pitching and caused the breach on the southern embankment of the bridge. It is further the case of the Railway that the patrolling of the Track was duly done according to the regular system of patrolling during the monsoon period, as will appear from the Patrol Beat Sheets and charts of the night of 23rd November 1956 between Ariyalur and Kallagam stations.

The letters received from members of the public and from various Associations in response to the Notice published by the Commission in the Newspapers inviting the public to take part in the proceeding for Inquiry, came from Vellore, Mysore, Ernakulam, Coimbatore, Trichinopoly, Chidambaram, Kumbakonam, Virudhunagar and other places in Madras.

Some of the letters contain vague suggestions about the safeguards to be taken for prevention of future accidents and some of the letters made suggestions about unusually high speed of the train, the want of vigilance of the Patrolman and dereliction of duty on the part of Engineers and Station Masters and other factors, being the causes of the accidents.

As the Commission felt that all such questions could be raised or agitated by the parties who had been allowed to intervene or take part in the proceeding, the presence of all these who had addressed communications to the Commission was not necessary and accordingly no steps were taken to procure their attendance at the sittings of the Inquiry as adoption of such a course would have unnecessarily protracted the inquiry.

The parties allowed to intervene have filed separate statements of case.

In the Statement of case filed by K. N. Ganesh, a passenger in the ill-fated train, it is stated that the train when it started from

Ariyalur did so with an unusual speed like an Electric train, of about 30 miles per hour. Within a minute or two of that the accident occurred and he was thrown into the stream. His wife, his son and his mother-in-law died as a result of this accident at the very site of the accident. No timely aid was given to the persons involved or injured in the accident. He knew from villagers who gathered there to render assistance, that owing to a breach in an adjoining tank the river had overflown. The warning of this had been given to the Station Master Ariyalur and he was asked not to allow the train to run on the bridge.

On behalf of the Advocates' Association, Madras, a Statement had been filed. It is stated that in 1937 the flood waters overtopped the river bank and so this was sufficient warning to take precautionary measures and to add another span or two to the existing spans. The bridge should not have been built near the bend of the river. The past rainfall reports of Ariyalur and Perambalur show that heavy floods are not unusual in the locality. The river Marudayar is a freak river with a catchment area having a number of tanks and tributaries. Further no precaution was taken in piloting the train over the bridge. The night patrolling of the bridge and the track was not satisfactory nor properly done. The patrolman had no torchlight and so could not make detailed observation. The relief operations were delayed and medical relief was not timely given.

K. Anandan Nambiar, a member of Parliament has also filed a Statement. This statement has attributed negligence and indifference to the Railway Administration. It is stated that although the Tahsildar reported breaches of tanks, the Permanent Way Inspector and the Assistant Permanent Way Inspector did not consider it necessary to trolley their sections or to post stationery watchmen on the bridge and thus violated rules 1104 and 1102 as laid down in the Way and Works Manual. The night patrolman normally on duty reported that the river Marudayar was in heavy floods and in turbulent condition and yet no caution was given. The result was that the driver not scenting any danger ahead drove with sufficient speed and the train crashed immediately after crossing the Trichinopoly side abutment of the bridge. The cause of the accident was that the Southern abutment of the bridge had cracked as its foundation was shaken due to erosion caused by strong current of the flood. Moreover seven Express and passenger trains and some goods trains passed over the spot and the impact of these trains had shaken the foundation of the abutment and as a result of the impact of the ill-fated train the abutment finally gave away. It is further alleged in the Statement that there were proposals for safety works to be carried out for the Marudayar bridge but there was delay for two or three years in sanctioning the proposals. It is also pointed out that the Hyderabad Railway Accident at Jangaon and Mahaboobnagar in 1954 and 1956 should have been eye opener to the Railway Administration but they refused to take their lessons from such accidents. It is further pointed out that the integration of the different railways has made the Southern Railway unwieldy and has affected the efficiency of the Railway Administration. The equipments of gangmen are inadequate. They should be provided with torch lights and footwear and their beat lengths should be reduced. The Statement also accuses the railway officials of not providing rescue operations in time.

On behalf of the Railway Administration several witnesses have deposed before the Commission.

K. S. Vaidyanathaswami, the Guard of the train No. 603 Express who was on duty at the time of the accident has stated that the train left Ariyalur at 5-21 hours and he felt shock and jolting at 5-28 hours. At that time it was pitch dark. At about 5-50 hours he could see things clearly. He saw that the water was touching the bottom of the girder level and there was a ferocious noise in its rush. He saw the water-level on the upstream side only. He experienced no rain during the run, and there was no rain when the train was at Ariyalur Station or at the site of the accident. The speed of the train according to this witness was 35 to 40 miles per hour. The weather was foggy and the visibility was poor. The witness has stated further that between Pennadam Station and Mathur Station the train was cautiously piloted some distance by a gangman as another river Anavari Odai was in heavy floods and the flood water had made the railway track dangerous for the train to run. The witness saw the water flowing underneath the girder level. This fact indicates that it was not only the river Marudayar which was in floods but other rivers of this railway section were also in spate. The witness has also stated that as the train was running late there was anxiety to speed up but at the Marudayar bridge the train was running at the normal speed. The witness was questioned about the discrepancy between the time of accident as recorded by him and the time mentioned in the Statement of Case of the railway. The discrepancy is of one minute and has no material bearing on the matters relevant to this inquiry.

The next witness called was Mr. Vasudevan, the Assistant Station Master, Ariyalur. This witness has stated that patrolling by night patrolman was always according to the schedule. The patrol beat sheets curiously show that every night the time of arrival and the time of departure of patrolman is shown as having been at the same time. The witness has however maintained that the timing has been recorded exactly as the patrolman arrived and departed. But it does appear improbable that the patrolman was so very punctual every night as suggested. It is likely that the recording of time on the beat sheets does not correctly represent the actual state of affairs, and it was done in a mechanical manner. The witness has stated further that on 19th, 21st or 22nd November there was no heavy rain but drizzling and intermittent rain. The witness has admitted that he received a telegraphic message from Tahsildar, Perambalur that near the river Anavari Odai a tank had breached and the railway line between Pennadam and Mathur had become dangerous and he conveyed this message to the Permanent Way Inspector and to his Assistant.

Vincent Raj, the Relieving Assistant Station Master has corroborated this fact of regular night patrolling. He has stated that the night patrolman named Innasimuthu duly got the Beat Sheets signed by him twice in respect of the two beats that the patrolman had done during the night of 22/23rd November 1956. Now, although the beat sheets, as I have observed already, do not perhaps record the correct timings of arrival and departure of Patrolman with regard to each and everyday as recorded in the sheets, I have no doubt that the

patrolling was being done and Innasimuthu had patrolled the bridge on the night of the accident.

The witness has stated further that there was moderate rain from 0/30 hours till 1/30 hours and after this it continued to drizzle intermittently.

The witness has denied that the train No. 603 started from Ariyalur at a considerable speed. He has stated that no patrolman reported anything unusual about the water level in the Marudayar river. The witness has admitted that there is a curve in the railway track at 170 to 177 miles.

The next witness Subramanian, the Assistant Station Master, Kallagam, has stated that the night patrolman arrived at 23-45 hours or so and left at 0-0 hours towards Ariyalur. There was heavy rain from 0-0 hours to 4-20 hours. The timing of arrival and departure of patrolman noted in the patrol sheets is correct, though the same timing is recorded everyday.

Mr. C. Rodrigues who was a passenger in the train No. 603 has also deposed. Soon after the accident he flashed his torch into the water of the river and he saw chips of trees sticking on the bridge at a height of 2 feet. He did not see water flowing over the bridge. He did not notice any rainfall during the journey.

Dawson, the driver of the 620 Express stated that he left Kallagam at 2·38 hours on 23rd November 1956 and arrived at Ariyalur at 3 hours. There was slight rain between Kallagam and Ariyalur. There was very little water in all the rivers which he passed. The running between the section was smooth. The witness did not see any night patrolman between Kallagam and Ariyalur but he saw a few night patrolman between Villupuram and Trichinopoly on the night of 23rd November, 1956. He passed over the Marudayar bridge at about 2·55 hours and he saw that the water in the river was two feet from the bed level. How is it possible to see the water level on a river bed when a driver is driving the Engine over a bridge at speed of 35 or 40 miles per hour passes my comprehension. It appears to me that the witness did not see the water level on Marudayar at all and this portion of his testimony is definitely untrue.

Fraser, the driver of No. 619 train which ran from Villupuram to Trichinopoly arrived at Ariyalur at 2·10 hours and left Ariyalur at 2·16 hours having stopped at Ariyalur for 6 minutes for loco purpose. He did not see any night patrolman on any section between Villupuram and Trichinopoly on that night. Between Pullambadi and Valady he experienced moderate rain.

In course of cross examination the witness has admitted that when passing a bridge it is not possible to see the level of the water but the water can be seen. He saw little water in the Cauvery bridge. The witness sometimes complained about the glass fitted to an YP Engine as the visibility through it is not always satisfactory.

Mr. Manickam, the Driver of the Train No. 605 Madras-Trivandrum Express arrived at Ariyalur at 2·33 hours and left at 3·3 hours on 23rd November 1956. Between the bridge No. 252 (Marudayar

bridge) and Sillakudi halt he saw the night patrolman standing and showing No. 2 light to him. He also saw some patrolmen between Villupuram and Trichinopoly. There was light rain experienced by him during the journey. He did not notice flood water passing through major bridges at high velocity. He noticed very little water at Marudayar bridge. But on being further cross examined he has stated that it was not possible to see the level of the water under the bridge. He has stated further that during rainy season nothing can be seen through the glasses fitted to the YP Engine. The YP Engines that are being used for Express trains are good.

Abdul Rahiman, the driver of the 606 Trivandrum-Madras Express on 22/11/56 has stated that he experienced rain throughout from Madura to Villupuram but water was running normally in rivers and culverts. He passed the river Marudayar at about 0/31 hours. He did not see any night patrolman between Kallagam and Ariyalur but he saw some between Ariyalur and Villupuram.

In course of cross examination he has stated that there was heavy rain between Ariyalur and Virdhachalam but between Trichinopoly and Ariyalur there was little rain.

Abdul Razack, the driver of the Dhanushkodi Passenger No. 607 on the night of 22/11/56 has stated that between Villupuram and Kallagam there was drizzling rain and the water was flowing normally under the culverts and bridges. He did not experience any jerks or rough running during the journey. In course of cross examination he has stated that there was light rain on the night of the 21st November 1956.

R. M. Moor, the driver of the Tuticorin-Madras Express No. 604 has stated that it was raining when he was coming from Trichinopoly to Villupuram. He arrived at Ariyalur at Zero hours. He felt no jerk on the track between Ariyalur and Kallagam. He found that there was not much water under the bridge over the Marudayar river.

In course of cross examination he has stated that he noticed water in the Marudayar which was about half bridge. But he has admitted at the same time that it is not possible to see things clearly through the glass fitted to the engine especially when there is rain.

It also appears that the time recorded by the witness when passing Kallagam is different from that which appears in the register of trains maintained by the Railway.

Mr. Coultrup, the Loco Foreman has also been examined and he has stated that some time after the accident he visited the site of the accident at about 13 hours and had examined the Engine of the train No. 603. He found the vacuum handle in the off position and the regulator in the closed position. The drift also was closed and the handle broken off.

In answer to questions put by the Government Inspector he has stated that the reversing lever was at 45 per cent. cut off while the injector feed handle was closed. He has admitted that the normal position of the reversing lever would be 45 per cent. if the train was run at full speed over the bridge.

It is thus clear that the driver did not receive any indications of any danger while coming near the bridge or while crossing it and the train had been running at full speed. The witness has suggested in course of cross examination that the regulator of the Engine might have been closed because the train had to run in down gradient after crossing the bridge.

The witness has also given the particulars of the overhauling of the Engine YP 2069 in May 1956 and in November 1956 shortly before the accident. These particulars suggest that proper attention was being paid to this Engine and by timely repairs and overhauling it had been kept in a good condition, and the standard of its efficiency was duly maintained.

V. Krishnaswami the Station Master, Ariyalur, has stated that he did not know the name of the patrolman who came to take the patrol sheet from him on 22nd November 1956. He usually identifies, the patrolmen from the equipments they carry. There can be no doubt that this is an unsatisfactory way of identifying a patrolman inasmuch any person who presents himself with the equipments can pass himself as a patrolman although he is not the real person who is required to be on duty. The witness has stated that he records the timings on the patrol sheets according to the hours at which the patrolman goes out on his beat or returns from the beat and in actual practice the patrolman always comes back in time and he is never late. This is again a statement which is too sweeping in its nature. The witness has admitted that he received a telegram from the Tahsildar of Perambalur at 6-40 A.M. on the 22nd November 1956 to the effect that "Thungapuram Eri reported breached. Inform Mathur Station. P. W. Inspector for Railway". The witness has stated that there was drizzling rain during the four days, 19th, 20th, 21st and 22nd November 1956.

T. Selvaraj, the Revenue Divisional Officer (Deputy Collector) has stated that there was incessant rain on 22nd November 1956 and he has given the records of rainfall in Perambalur and Ariyalur on 20th November 1956, 21st November 1956, 22nd November 1956 and 23rd November 1956. On the last mentioned date the rainfall at Perambalur was 4·20 and at Ariyalur 3·75.

There is only one railway affecting tank in the Perambalur taluk known as Turaimangalam which affects the river Marudayar but there was no breach in this tank on the 22nd or 23rd November 1956. But out of 30 minor irrigation tanks and 11 P.W.D. tanks eight minor irrigation tanks and five water ponds breached that night (*i.e.* 22nd November 1956) including the Ramalingapuram tank. Although the witness was camping at Perambalur on the 22nd November and on 23rd November and came to know that the Marudayar river in its upper reaches had overflowed that night and destroyed several houses at Siruganpur, Maderi, Kurikallur and Iruppakudi villages, he came to know of the breaches of the eight irrigation tanks and the five ponds only on the 29th November 1956. The witness has also given the records of rainfalls for four months (August to November) in the Perambalur and Ariyalur areas during the 17 years from 1940 to 1956 and it appears therefrom that the rainfall in 1956 was the heaviest, recording 35·75 in Perambalur and 45·38 in Ariyalur.

The witness has stated that it is an year of abnormality with regard to the rainfall. The witness does not know whether the test of railway affecting tanks is periodically or at all reviewed or not. It is further stated by the witness that his overseers had calculated that 12,757,236 cubic feet of water had escaped through the breaches in the eight irrigation tanks and the five ponds. It further appears from the evidence of this witness that on the curve near Razoolabad the river Marudayar overflowed by 4 feet from the brushwood and 4 feet from the land. It had overflowed the margins. According to the witness there have been no such flood in living memory.

Subramania Pillai, the Tahsildar Manager, Ariyalur, has stated that the accident took place in the limits of Ramanathapuram village. On hearing the news about the accident he went to the spot of the accident on foot at about 7 or 7-30 A.M. and when he went there he found the water in the Marudayar river flowing very forcibly to the entire width of the river and the Patta lands at both ends of the river were under water. The water level was about 1 or 1½ feet below the girder. The witness came to know that a small irrigation tank in the limits of Ramalingapuram village had breached on the night of 22nd November 1956 and the breached water had got into the Marudayar river which was at a distance of about 200 feet on the north of the tank. The witness has stated further that there was heavy rain on the night of the 22nd November between 11 P.M. and 1-30 A.M. and after that it was drizzling.

In course of cross examination the witness has stated that another tank Makkaikulam which is one and half miles to the west also breached and the water flowed into Marudayar river. The area of the Ramalingapuram tank is 5 acres and the area of Makkaikulam is 6 acres.

Palaniadi Odayar, the village Munsiff has stated that there was heavy rainfall on the night of 22nd November 1956 and enormous water was going into the channels. He had never before seen flood waters rising up to the height that he saw on the night of the 22nd November 1956. The tank near Razoolabad got full due to rains and thereafter breached. The rain began to fall at 8 P.M. and it became heavy from about 11 P.M. The rain became light at about 2 A.M. and completely stopped at about 5 A.M. The witness never saw such heavy rain before. He reported to the Tahsildar about the rainfall 2 or 3 days after. According to the witness there was little water in the river in the previous evening. This witness was unable to follow many questions which were put to him with the result that he has given inappropriate and irrational answers to such questions.

Annamalai, the Talayari, who lives in a village which is about 3/4th mile from the Marudayar river, has stated that at about 5/15 hours he heard the noise of the passage of a train over the girder bridge and all of a sudden he heard a terrific noise and he saw that the headlight of the engine suddenly disappeared. The witness reached the site of the accident at about 6 hours and noticed the flood waters spilling over at the girders at about the sleeper level but he did not notice any eddy currents on west or east side of the south abutment of the bridge. The water was flowing with a moderate velocity along the bank. The evidence of the witness further is that

for the last four months there was not a single day when it was not raining. But it was on the night previous to the accident that there was heavy rain throughout the night and the kind of flood that occurred was never seen before. The crops like cholam, ragi etc. got very much damaged by reason of the heavy rains.

Michael, the Tahsildar, Perambalur, has stated that he assumed charge as Tahsildar on the afternoon of 20th November. There was heavy rain in Perambalur between 11 P.M. and 4 A.M. in the night of the 22nd November. About 4·20 inches of rain fell that night. He came to know on the 29th November 1956 about certain breaches of tanks in Tinnanur village. Even before this rain some of the tanks were full and they were surplussing normally but there was no overflowing. After the heavy rain of 22nd/23rd the witness alerted the village officers to be on the look out and report. He has stated further that as the Tungapuram Eri is three miles away from the Mathur Railway Station and he received report of a breach in that tank from the village munsiff he sent a telegram to the railway authorities since the breach was in the vicinity of the railway line.

Kolandaivelu Odayar has stated that he is an inhabitant of the village Razoolabad which is at a distance of 24 minutes walk from the Marudayar bridge. There was rain on the 22nd November and this caused damage to landed properties. There were also floods in the river Marudayar and the villagers were leading away the cattle and carrying away their things to safe places which were on higher level. Due to heavy rains this year all crops have been lost.

Ayyamaperumal, another villager of Razoolabad village has also stated that there was heavy rainfall on the 22nd November but there were floods on the day of the accident. He had not seen any such flood before. There was overflowing of Marudayar river and inundation of the villages one hour before 5 A.M.

Abdul Khadar, the Assistant Engineer, Highways, Ariyalur, has stated that a road bridge over the river Marudayar, which is at a distance of about two miles from the railway bridge, where the accident happened, and which is known as the Varanasi bridge suffered scour to a depth of about 15 feet under the foundation of its two northern piers, and the two piers collapsed, at about 5-30 A.M. in the morning of the 23rd November 1956 as a result of the heavy floods in the river. Before this there was never such heavy scouring. The only scouring experienced was to the extent of about 6 or 7 feet below normal bed level. There were guide bunds on the southern abutment side but there were no guide bunds on the northern side as there had been no flow in this direction. The bridge was designed for a maximum discharge of 25,400 Cusecs, and the waterway provided was 3150 Sq. ft. with 10 spans of 30 ft. each. The normal flood level was taken as 96·60 and the maximum flood level adopted for the design was 105·60. The abutments were constructed in 1925, that is about three years prior to the construction of the railway bridge.

In the floods that took place in the river on 23rd November 1956 there was scouring of about 2 ft. of both the embankments. Prior to 23rd November 1956 there were small breaches taking place here

and there near the culverts and other bridges and precautionary measures were accordingly taken. Some of these breaches were about 3 and 5 miles away from Ariyalur.

According to the witness, there was discharge of about 52,400 Cusecs in the 23rd November floods. The maximum water that overflowed the road length was 3 inches and the water overflowed the Ariyalur side on two places for a length of 180 feet and 380 feet, and on the Trichy side to a length of about 134 feet. But on the 21st November 1956 there was 3 feet of water in the first four vents on the Trichinopoly side and there was no flow on the Ariyalur side.

V. Ramaiya, the retired Chief Engineer of the South Indian Railway, Trichinopoly, has stated that for about a year prior to May 1929 he was Assistant Engineer at Ariyalur. When he took over, the construction of the chord line and the bridge was in its closing stages. Braithwaite & Company did the construction work of the Marudayar bridge No. 252. The supervision of the bridge was directly done by the Engineer-in-Chief. This Braithwaite & Company also constructed the reinforced concrete abutments of this bridge No. 252 on the same design as those already employed by them when constructing the Cauvery and Coleroon bridges which were constructed prior to undertaking the work on bridge No. 252.

According to the witness the provision of 8 spans of 62 ft. 3 inches is found to be quite ample for the run off and a clearance of 3 to 4 ft. below the girders is quite adequate.

The contour condition of the area in which the Marudayar runs, conforms to those of a midland catchment with gently rising or falling contours. The catchment area is understood to be about 150 square miles and the total run off as ascertained according to the Public Works department formula is 11,000 Cusecs. The linear waterway is 500 feet. The river Marudayar runs parallel to the railway line at about 1600 feet from it, at the south of the bridge. The spill water from this place and the flood water of the river Marudayar had their confluence at the south approach of the bridge and eroded the formation behind the south abutment.

The witness has stated further that the information that he has received about the breaches of eight minor irrigation tanks and five water ponds, makes it clear that the water escaping through these breaches also contributed to an appreciable extent the very high level of the flood waters in the river Marudayar on the 23rd November 1956. According to the witness on a rough computation the water due to the breaches and the surplussing, would come to 33,750 Cusecs. Further the coalescence of the flood waters from the neighbouring catchment areas also augmented the floods and another factor which accounted for the heavy flood was the denudation of the catchment areas by removal of shrubs, jungles and trees.

Although the witness has laid great emphasis on the breaches of the 8 minor irrigation tanks and five ponds as substantially contributing to the heavy floods of the 23rd November 1956 it is clear from the evidence of other witnesses on this point, that the contribution of the breaches of these tanks and ponds was much less.

The witness has also made it clear that in South India, because of the intensity of the rainfall, the adoption of Ryve's and Kutter's formula is more appropriate than adoption of Inglis formula which is suitable for the Bombay province.

Asked about the gradients on both sides of the river Marudayar the witness has stated that when rivers have to be crossed, there would be rising gradients on either side and the bridge will be on the lower level.

The witness was repeatedly asked in cross-examination whether the clearance space of 3·9 ft. between the designed highest flood level and the bottom of the girder was sufficient and he has maintained that this was adequate and the highest flood level recorded in 1937 when there was discharge of 16,000 Cusecs confirmed that the clearance was adequate.

The witness has expressed the view that as a protection measure there must be liberal provision of spillways, and the only real safeguard is patrolling.

It is also stated by the witness that there are rules and instructions to the effect that when the water level rises to about one foot below the girder precaution must be taken and if a watchman sees the water level increasing, say one foot below the girder level he should take his stand there and should not proceed further.

In answer to questions put by the Assessor Mr. Khanna the witness has stated that the construction of screw pile type of bridge was undertaken because the idea was to finish the bridge as quickly as possible but he cannot say whether the cost of this kind of construction was less or not.

In answer to Mr. Venkatachari's (Assessor's) questions the witness has stated that having regard to the record of 3 inches rainfall in three hours and assuming that discharge of 50,000 Cusecs would represent $\frac{1}{2}$ inch rainfall in the whole of the catchment area in an hour the rainfall of one inch per hour would result in greater discharge.

It is not necessary to deal with the evidence of this witness any more.

V. S. Ramaswamy Iyer, the retired Assistant Engineer, Vridhachalam, who was in charge of Kallagam-Villupuram Section during 1941 to 1944 has stated that in November or December 1941 there was a Cyclone in that area and in 1941 or 1942 there were breaches at some places, but there were no breaches or any trouble in the bridge over river Marudayar. Some pitching was however redone on the Madras side of the river Marudayar and a Groyne was put up. The rivetment was taken about 2 or 3 feet below the bed level. The river was at the time pressing the Madras side.

In answer to questions put by the Assessor Mr. Khanna, the witness, after giving certain evasive answers, was forced to admit that the bridge over the river Marudayar was an important bridge but yet it was classified as an unimportant one and no guard or

watch was kept over it although it should have been kept under guard. But according to the witness, the river was not important and so no watch was kept over it. The pitching on the Madras Side was done as a protective step because there was some erosion on that side and it was found necessary to do this work. The witness has also admitted that during heavy rains it was the duty of gangmen and gangmates to patrol the lines in spite of the usual night patrolman being on such duty. The duties of such gangmen were to watch and attend to the erosion of banks, the falling of trees on the section, proper covering of the station yard and clearing of obstruction to the permanent way.

T. Komaleswaran was the next witness called on behalf of the Railway Administration. He was the Assistant Engineer in charge of Vriddhachalam Sub-division during the period 6th July 1945 to 11th May 1946. During his inspection of the major bridges he used to walk up stream and down stream for about ¼th of a mile to see if the protective arrangements like guide bunds, rivetments, etc. were intact.

In course of cross examination the witness has stated that if there is cyclonic weather he would alert the employees subordinate to him but if there was heavy rain only he would not do anything. But it is the duty of the Assistant Engineers to keep watch and trolley the section if there was report of any heavy floods from Inspectors, gangmen or gangmates. The witness does not think that the addition of two or more spans to the bridge would have improved the position. The evidence of the witness further is that patrolmen should see whether the bridges were running full, or whether there were floods or breaches to the embankment or whether there was danger to the bridges. If the water in the river reaches the high flood level mark, he should stand there and see how the flow is, and should caution or stop train if necessary. According to the witness the gangmen are given instructions as to the High Flood Level marks and so a patrolman is acquainted with the High Flood Level mark. It may be noted here that the patrolman Innasimuthu whose evidence I shall have occasion to deal with later on, has stated that he has been taught about the High Flood Level mark on the bridge of river Marudayar after the accident.

In answer to questions put by the Assessor Mr. Khanna the witness has stated that on the recommendation of the Assistant Engineers a list of vulnerable points is prepared and there is a register maintained of the vulnerable points. The Marudayar bridge is not one of such vulnerable points. The Assistant Engineer also gets lists of railway affecting tanks from the District Engineer but besides noting the repairs done to these and inspecting them if necessary, no further steps are taken by the Assistant Engineers. The list is an yearly list.

S. Chaudhury, Engineer, who was in charge of the Golden Rock Sub-division from 18th October 1937 to 6th January 1938 has stated that during this period many places in the Chord Line had breached. The highest flood levels on bridge No. 252 (*i.e.* Marudayar bridge) and on other bridges were marked that year. The witness was

again in charge of Vriddhachalam Sub-division between 18th September 1944 and 11th March 1945 and he was the District Engineer, Golden Rock between 1st March 1946 and 22nd March 1946, but there were no floods during these periods.

In course of cross examination the witness has stated that while he was in charge of the Sub-division throughout the chord line he and others had to attend to breaches continuously during day and night working for continuous period of 17 days. According to the witness even after the highest flood level being 196·4 in 1937, the bridge did not require any special attention. The reason for the heavy floods of 1937 was unusual rainfall. The witness however did not take any steps to examine or survey the effects of the high flood in 1937 on the bed of the river. Although there were several breaches, the witness did not consider the desirability of raising any bank or of degrading any section. The cost of work of rivetment that was done to the northern bank of the river Marudayar near the northern abutment was charged to capital. This part of the railway was then a company managed railway. The witness does not remember whether this protective work was considered as of an urgent nature or not. The witness has admitted that as Assistant Engineer he used to get weather reports from Control. Whenever any report of any cyclone or heavy rain came, a copy of the report used to be given to the District Engineer, the Assistant Engineer and the Permanent Way Inspector, the gangs were alerted and the Assistant Engineers would carry out inspection on trolleys when necessary.

S. Puttaswamy, the District Engineer-in-charge of the Vriddhachalam Sub-division during January 1950 to February 1953 has also deposed before the Commission. He has stated that during his period there was very little rainfall. But during the monsoon period the night patrol was put on with instructions to watch the vulnerable points. There is a register maintained about the vulnerable points, and additions are made to the list if the occasion arises, but in his experience he has not found any addition being made to such list. If the water level of a bridge rises above the recorded flood level it is regarded as a vulnerable point, or if the safety of the railway track is affected at a particular point, such a point is also treated as vulnerable point. The witness however states that although the northern abutment of the Marudayar bridge was protected heavily and the approach to the south bank was pitched to a height of 4 ft. and this was evidence of the fact that the bridge was hit in the past, he did not think that this bridge was a vulnerable point or that it required special attention, or necessitated precautionary work. He however admits that it was the apprehension of the bank being scoured during floods which entailed the taking of the protective measures.

Abdul Azeez, the District Engineer, who was in charge of the Golden Rock Sub-division of the Trichinopoly district during May 1939 to August 1941 has stated that he inspected the Marudayar bridge and found that there was some little pitching near the northern abutment which had been disturbed and so he suggested construction of a groyne as the river was pressing towards the north.

He submitted proposals for the repair of the north abutment. The south abutment was good up to 500 ft. but further south to this 500 ft. he saw a little erosion of the bank and accordingly in 1941 he sent some proposals for pitching this portion to about 400 feet and the height was to be about 4 ft. These proposals were sanctioned after some delay, and the work was done three years later in 1944-1945. This delay does not reflect much credit on the then Engineering department.

In answer to questions put by the Assessor Mr. Khanna, the witness has not been able to say as to what that erosion of the 400 ft. in the south approach to the bridge No. 252 was due to, nor has he been able to say why no precautionary or protective measure was taken to prevent a possible erosion of the portion between the eroded point and the south abutment of the bridge, except that it was to minimise the cost of expenditure that the pitching of the eroded portion only was taken up. The witness has evaded direct answer to the question of Mr. Khanna as to why the bridge was not included in the list of vulnerable points, by taking shelter under the plea of forgetfulness and he has stated that in his handing over notes which he gave to his successor, there was mention of all these things. But these handing over notes are not forthcoming.

It is clear from the evidence of this witness that the proposals that he submitted for the protective works to the north and the south sides of the river, passed through the hands of the then District Engineer and the then Chief Engineer and yet the bridge failed to find any place in the register of vulnerable points. This attitude on the part of the Engineering department of the Railway cannot be described as anything but an attitude of utter indifference or carelessness.

M. Ganapathy, the Chief Engineer of the Southern Railway has stated that on receipt of the letter of the Director, Civil Engineering, Railway Board, dated the 2nd December 1954, and bearing No. 54/W/10/31 addressed to the General Manager, he caused copies of this letter to be forwarded to the Regional Engineers, Trichinopoly, Royapuram and Mysore along with his forwarding letter No. W/9663/CE/69, dated 11th December 1954 to the following effect:—

Chief Engineer's Office,
Madras
11-12-54.

SUBJECT.—*Inspection of Bridges.*

I send herewith a copy of the Railway Board's letter No. 54/W/10/31, dated 2nd December 1954. The instructions contained in the Board's letter should be strictly followed and action should be initiated immediately and completed before the onset of the next flood season. Your report regarding the action taken should be submitted by 15th January 1955 to enable me to advise the Railway Board.

(Sd.) B. K. KUPPUSWAMI,
for Chief Engineer.

It appears that the Regional Engineer, Trichinopoly, in his letter No. B/51/4G/59, dated 22nd February 1955, wrote as follows:—

"The reports of D.E.N.S. (District Engineers) touching the various aspects pointed out in the Railway Board's letter have just been received and these are being examined in detail. This is for your information."

(Sd.) SYED SIRAJUDDIN,
for Regional Engineer.

The Regional Engineer, Royapuram, on 20th April 1955 also wrote a letter to the Chief Engineer in a somewhat similar strain. The letter was as follows:—

"I have received from the D.E.N.S./GVN, BZA, GY, SA and SRR lists of bridges coming under the classification of having "past history" due to causes enumerated in para. 2 of the Board's letter. Particulars of these bridges are furnished in the attached statements. These are being inspected by me and a report will be sent as soon as the inspection is completed."

(Sd.) M. A. CHACKO,
Regional Engineer.

On receipt of this letter of the Regional Engineer, Royapuram, the Chief Engineer by his letter, dated 6th May 1955 drew pointed attention to para. 2 of the Railway Board's letter and further stated as follows:—

"It is noted from your above that you are only inspecting those bridges included in the list submitted by the D.E.N.S. having a past history, but this is not in accordance with the Railway Board's intention. Please therefore scrutinise *personally* the Inspection Reports *of all the bridges* in your jurisdiction as required in the Board's letter to make a selection of the bridges with a past history. Your inspection reports on such bridges should be submitted before the onset of the next flood season".

(Sd.)
Chief Engineer.

"Copy to Regional Engineer, Trichinopoly, with reference to his No. B. 51/4G/59 of 22nd February, 1955.

He will please see whether he has scrutinised the reports of all the bridges in his jurisdiction for making a selection of those that require his inspection. His inspection reports of the bridges with a past history should be submitted before the onset of the next flood season."

Then again on 20th/21st September, 1955 the Chief Engineer wrote another letter to the Regional Engineer, Trichinopoly, to the following effect:—

"Your report deals only with grouting of cracks and plastering of withering bricks etc. The nature of the seriousness of

the defect has not been detailed in the report. For bridge No. 60 at Mile No. 239/14-15 you have suggested that this may be removed from CE 51 although this bridge is strutted due presumably to the weak condition of the bridge. Why not we rebuild it?

2. In addition to the information that you have collected, your inspection should also include bridges which have insufficient wentway, bridges which were previously affected by floods, bridges whose spans have been silted up and also bridges whose foundation might have been scoured etc. Please therefore arrange to complete the inspection of all the bridges in your jurisdiction as noted above and submit your detailed reports."

(Sd.) * * *

for Chief Engineer.

There was some further correspondence between the Chief Engineer's office and the Regional Engineers but it is not necessary to set them out or to deal with them in any detail.

It also appears that by its letter No. 54/W/10/31, dated the 19th October, 1956 the Railway Board issued the following circular:—

"To

The General Managers,

All Indian Railways,

SUBJECT:—*Inspection of Bridges.*

In continuation of this office circular letter of even number, dated the 3rd September, 1955 on the above noted subject, the Railway Board desire that the Chief Engineer of your Railway should study the conditions prevailing at individual bridges generally and sites with past history in particular. It is also desired that after proper study they should take remedial measures as necessary in regard to the following:—

(a) to increase waterway where called for,

(b) to protect foundations against scour,

(c) to protect approaches to the bridges, and

(d) to raise height of formations and strengthen bank as necessary against headway water.

(Sd.) B. C. GANGULI,

Joint Director, Civil Engineering,

Railway Board."

Mr. Ganapathy has stated that the Regional Engineer, Royapuram, selected 82 bridges, the Regional Engineer, Mysore, selected 35 bridges and the Regional Engineer, Trichinopoly, selected 20 bridges but the Marudayar bridge No. 252 was not among those selected by the Regional Engineer, Trichinopoly, and the witness thinks that the bridge has been rightly excluded.

The witness is of the view that a groyne or guide bund on the upstream side of the south abutment of the Marudayar bridge would have diverted the waterway from the south abutment and prevented the breach but the necessity for this had not been revealed by the floods in previous years which did not cause any spill water, and consequently it would be difficult to justify the construction of groynes or guide bunds to prevent possible erosion by spill waters. But in view of the erosion of the 23rd November, 1956 of the approaches to the bridge No. 252 and under its south abutment, he thinks that it is necessary to provide protection bund or groyne on the upstream side of each abutment, at every bridge.

In course of cross examination he has stated that he relied entirely on the reports of the Regional Engineers and did not do any independent or test checking. There are about 20,000 bridges under his charge.

Suggestion was made in course of cross examination to the witness that the integration of the Southern Railway, the M.S.M. Railway and the Mysore Railway has made the task of the Engineers and the other officers more difficult and has affected their efficiency with the result that accidents are taking place and human lives are being lost in large numbers. But it is to be remembered that even before integration accidents were not unknown in railways.

The witness has stated further that gangmen are not provided with railway quarters and when alerted they have to be collected from their village homes.

It also appears from the evidence of this witness that each Regional Engineer is in charge of about 7,000 bridges and it is out of these that they have to select the bridges which require special attention.

According to the witness the increase of the floods in the rivers at the present day is due to increase in the rainfall.

The attention of the witness was drawn to the reports of the Railway Board for the years 1952-53, and 1954-55 and he has stated that damage to the track in 1952 was due to trees falling on the track by reason of cyclonic weather.

The witness has described the manner in which the scouring under the Southern abutment of the Marudayar bridge took place and brought about the subsidence of the track on the southern approach to the bridge and thus resulted in the accident to the 603 Express train.

The witness was put a number of questions about the design and construction of the bridge and the sum and substance of his evidence is that no fault can be found about the design and the construction. According to the witness exceptional floods are not provided for in engineering practice in the matter of design and construction of bridges. Even if more spans had been provided that would not have improved the bridge or averted the accident.

The witness does not agree with Ramaiya (the retired Chief Engineer) that the breaches of the tanks contributed to the flood to

any large extent. The information about breaches of tanks is supplied by the Public Works Department and these are forwarded to the Engineers. The railway authorities do not take steps on their own to collect this information, as they have no staff. The witness had also at first stated that if he had known that the bed of the river had scoured out in Span No. 1 to the extent of 6 to 7 feet, that the river had the tendency to overflow on the south and attack the approaches to the bridge at Mile 171/18-19, that the river had the tendency to shift towards the approach of the bank at this place and the south abutment was resting on sand and clay unlike the north abutment which was resting on clay, he would not have excluded the bridge from the list of bridges that require to be kept under observation. But later on in an affidavit affirmed on 3rd January 1957 the witness has corrected this answer, and has stated just the opposite.

The witness inspected the bed of the river after the accident but did not find any scour of the bed except at the piers. The estimated discharge of the river at the time of the accident, according to calculations subsequently made, was 51,300 cusecs. This figure was arrived at assuming the slope of the bank as 1 to 2 and it was taken only 1,000 feet downstream of the bridge and 700 ft. upstream, of the bridge; but this may not be a reliable calculation. According to the witness the water level had touched the bottom of the girder at about 3-50 A.M. and had reached the maximum height at 4 or 4-30 A.M. and from 4-30 A.M. the water level had begun to fall till it came to the bottom of the girder at about 5-15 A.M. and at the time of the accident it was one foot below the bottom of the girder level. The witness agrees with the suggestion that the flood water started eroding on the upstream side at the corner of the abutment and formed whirlpool, and this formation of the whirlpool resulted in the stone being removed from the abutment, in addition to the scour that was created and which had undermined the abutment. The erosion was, however, not due to any weakness of the bank but due to mainly of the confluence of the two streams breaching the abutment and starting the scour. The witness has stated that the 1937 flood did not produce any scour.

As regards safeguards, for the prevention of similar accidents in future the suggestion of the witness is that stationery watchman should be posted and there should be fixed signals provided at the bridge but these can be taken off when the bridge is found to be safe and the driver's signals should also be fixed signals and these should be at an adequate distance from the bridge. The patrolmen should be provided with torches or fairly good electric lights.

According to the witness the patrolman concerned failed to do his duty.

S. Venkataramanan, the Deputy Chief Engineer (North) was the next witness on behalf of the Railway. He was District Engineer in charge of the Trichinopoly section between March 1953 and August 1954. He inspected the bridge No. 252 twice—that is on 29th July 1953 and 24th July 1954 and found the bridge to be sound. The witness was Regional Engineer of the Trichy region between 26th March 1955 and 31st May 1956. In 1953 he found a vertical crack on the Ariyalur side abutment but as it was negligibly harmful, nothing

was ultimately done to it. As Regional Engineer he had studied the history of this bridge but was satisfied that there was nothing to be done with regard to this bridge. The flood level of 1937 was taken into consideration in arriving at this conclusion. The bridge is in existence since 1928 but there has been only 6 inches of scour on the Villupuram side and little accumulation of silt of about 5 to 6 inches on the Trichy side. The whole selection of bridges as directed by the Railway Board's circular was done exclusively by the witness. It took him 3 to 4 months to select the bridges. The selection of 20 bridges was done on the basis of the previous history. In spite of the fact that in 1937 there was flood, and in 1941-1942 there was erosion of the embankment on the Trichy side to the extent of about 400 feet and there was crack discovered on the northern abutment in 1953, the witness did not consider this bridge as one requiring any special attention. The witness has stated further in answer to certain questions put by the Assessor (Mr. Venkatachari) that he had never examined the foundation of the rivetment on the Trichy side nor had he any plan at any time showing that rivetment, nor did he feel the necessity of calling for a plan because he thought that the rivetment was good. This shows that the witness was not all serious in his examination or inspection of the bridges and the work done by him was done in a perfunctory manner.

The witness thinks that a flood light of an automatic device at some point on the river bed near the bridge which will show the increase in the flood level when it passes the mark of the previous maximum flood level, will provide some safeguard for prevention of similar accidents in future.

M. M. Samiullah, the Assistant Engineer, Vridhachalam, has stated that he last trolleyed over the Marudayar bridge on the 9th November, 1956. At that time there was no water flowing in the river. But this statement is obviously not correct because usually at this time there is bound to be some water though the volume of it may be very little. On 7th May 1956 the witness inspected the bridge but no written notes were kept of this inspection. According to the witness it is the duty of the patrolman while going over the bridge to notice whether the water level was rising or whether there was danger to the bridge and if he noticed any rise his duty was to stop the train, and send or give intimation to the Permanent Way Inspector and act according to his advice. The Marudayar bridge was not a specified bridge and so no survey of the course of the river was ever held. Whenever any weather report of heavy rainfall is received, the patrolling is intensified. As soon as he received the telegram from the station master of Agasthiampalli on the night of the 19th November, 1956, about the danger of heavy rain and cyclone for the next 48 hours, he alerted the Permanent Way Inspector and instructed him to alert his men and he himself trolleyed from Senthurai to Vridhachalam. It may be noted here that these weather conditions disappeared after the lapse of 48 hours.

The witness has stated further that he has now and then inspected the register of vulnerable points but he had no occasion to add anything to the list nor has he noticed any addition being made. With regard to the patrol sheets (Ex. 4 and 5) the witness has stated that as the patrolmen come and go regularly the time recorded about

their departure and arrival is uniform. But this, as has been pointed out already, cannot be true. It appears that the same time is recorded almost mechanically, perhaps with the idea of not harming the patrolmen concerned by recording the fact of any delay in arrival on any particular occasion. The witness has stated further that there is proposal for construction of railway quarters for gangmen but it has not yet materialised. In case of emergency the gangmen have to be called from their village homes.

P. V. Sundara Rao, the Divisional Engineer No. II, Trichinopoly has stated that on receipt of telephonic message from Divisional Engineer No. I at about 6·55 hours, he made arrangements and arrived at the spot of the accident at 9·45 hours. He found that the carriages were crushed to smithereens and bunched one over the other within a small ditch of 70 feet and so the casualties were high. The witness came to the conclusion from the clues present that the flood water level rose to the level of the bridge timbers over the girder bridge. But in course of cross examination the witness has admitted that the clues were unreliable and so this conclusion about the water level is not correct. The night patrol beat sheets were secured by the witness and the statements of the patrolmen were recorded. The breach of a small tank on the upstream side of the railway bank in the mileage 171/6 which occurred on the night of 22nd November 1956 was noticed. The witness has given a detailed description of the wreckages seen by him. He has stated further that he last inspected the bridge No. 252 on 19th October 1955 and recorded his notes as follows:— "Sound. Girders have been painted with one coat red lead and two coats red oxide". The river was almost dry when he inspected it and there was no sign of any scour. There had never been such flood in the river Marudayar as was experienced on the night of the 22nd/23rd November 1956. At the cyclone of 1955 no flood was reported. The witness is of the view that the total quantity of water discharged from the breaches of the 13 tanks was not appreciable. It was the unpredictable rain which was simultaneous on a number of places that had caused heavy on rush of water from a catchment area of 150 Sq. Miles. The witness noticed after the accident that the scouring had taken place in the first, seventh and eighth spans. According to the witness, the addition of another span beyond the first or the eighth span would not have improved the position. The discharge in the flood of 23rd November 1956 was three times more than the discharge of 1937. The witness has stated that patrolmen are punished for remissness in their duties, and has pointed out that one patrolman of Vridhachalam section named Veeraswami, was punished for sleeping while on duty on the 27th October 1955 and his increment was stopped for six months.

The witness has admitted that the statement of the night patrolman Innasimuthu who patrolled the bridge No. 252 on the night of the accident was recorded in Tamil in his presence by some Traffic Inspector who knows Tamil.

It was suggested to the witness that the area and the number of bridges under his charge being large it was difficult for him to manage the whole thing but his answer is that he feels that he can manage these things and there is no difficulty. The witness has

stated that he entertained some suspicion about the night patrolman on duty on the date of the accident and he has been put under suspension. According to this witness the accident in question was caused by heavy and abnormal floods.

As regards future precautionary measures the suggestion of the witness is that causeway can be provided if the local conditions permit or the formation level over the bridge can be raised.

P. N. Bhaskaran Nair, the Bridge Engineer, who took charge as such in May 1956, has also deposed. He calculated the discharge of the flood water on the 23rd November 1956 in the river Marudayar and his view is that it was 56,440 Cusecs assuming that water level rose 3 ft. above the bottom of the girders. The witness adopted Kutter's formula. If the calculation is made on the basis that the water in the river could pass with its level touching the bottom of the girders it would come to 30,240 cusecs. The calculated flood discharge for this catchment area at the time of construction was according to Ryve's formula 12,647 Cusecs, but the discharge worked out to 10,011 Cusecs according to Kutter's formula. According to the witness the flood that occurred on 23rd November 1956 can occur only once in more than 1,000 years. This is according to the Fuller's formula. The witness has not worked out the flood discharge of 1937 but his information is that it was about 16,600 Cusecs.

Some questions were put to the witness in course of examination by the Assessor, Mr. Venkatachari about the co-efficient to be adopted in making the calculations but it is not necessary to go into that matter for the purpose of this Report.

The witness has admitted that in making the calculations he has not taken into consideration the factor of any of the tanks in the catchment area breaching, or there being any scouring in the flood of 1937.

T. V. Soundararajan, the Permanent Way Inspector, Ariyalur, has stated that he received a telephonic message from the District Traffic Superintendent, Trichinopoly on 23rd November 1956 at 5-30 hours that the night patrolman had stopped the train No. 603 Express (*i.e.* the ill-fated train) at the approach of the Girder bridge No. 194 at mile 151/8-9 as the water level of the river Anavari Odai was rising and the train had been cautiously piloted by him. At 6 hours he got another information that the water in the river Marudayar had increased under Girder Bridge No. 252 and on coming to the Ariyalur station he learnt that the Train No. 603 had met with an accident at Bridge No. 252. He made necessary arrangements for relief and arrived at the site of the accident at about 7 hours.

The witness has stated further that on 19th November 1956 he received a warning from "Weather" Madras to the effect "Locally heavy rain likely your area next 48 hours". On the same date he also received a message from the Station Master, Agasthiampalli stating "Heavy rain and wind from 7 hours date. Suspect Cyclone like last year".

The message was received at 23·30 hours on the 19th. He alerted the men under him and on the next day trolleyed from Sendurai

to Vriddhachalam. On the 22nd November he also trolleyed this section between Kallagam and Ariyalur. When he passed over the Marudayar bridge he found that the water level was only one foot deep at some places on the bed of the river. The witness does not remember whether there was any rain on the 21st or 22nd November. On the 23rd November 1956 there was rainfall of about 3·75 inches. The witness knows the patrolman Innasimuthu who was on duty on the night of 22nd/23rd November 1956. At about 5-55 hours on the morning of 23rd November, the storeman came to his house and told him that Innasimuthu had informed the storeman that the water in the river Marudayar was rising. The witness was inside his house and so he did not see Innasimuthu along with the storeman. Innasimuthu did not tell him anything personally. But when he wanted to get the first hand information from Innasimuthu himself it was found that Innasimuthu had gone away to fetch the gangmate. It is to be noted however that from the patrol sheets its appears that the time of arrival of the night patrolman at Ariyalur station on the 23rd November 1956 is recorded as 5 A.M. The witness has stated that Innasimuthu was punished for neglect of duty on 28th September 1955 and his increment was withheld for six months.

A night patrolman takes about 2 hours to traverse the distance between Ariyalur and the bridge No. 252 on the outward journey and 2½ hours on the return journey in the first trip but in the second trip he takes 2½ hours on the onward journey and 2 hours on the return journey. This is because that he has not merely to walk slowly but has to inspect at some places and time is thus lost in inspection. The gangmen are not provided with railway quarters and they live in their native villages. In case of emergency it is practicable to collect the gangmen though it requires some time to collect them.

The witness has stated definitely that if the water level in the river Marudayar had risen above the 1937 flood level or was even two feet below the girder level it was the duty of the night patrolman if he was at the bridge, to stop the train and caution the driver. When the storeman (Ramaswami) informed him about the increase of the water in the river Marudayar he did not get the impression that the position was dangerous. In other words he did not suspect any danger.

The witness has admitted that he had no engineering training, but he could do instrument work as a result of his experience. He does not know how to measure the velocity or the discharge of the water in the river.

V. N. Jagannathan, the Assistant Permanent Way Inspector, Ariyalur, has stated that normally nine to ten inches of water flow in the river Marudayar. He knows Innasimuthu, the night patrolman who is diligent in his duties. Innasimuthu came to him at 5-50 hours on the morning of 23rd November 1956 and informed him that the water in the Marudayar was increasing. The witness asked the patrolman to inform the Permanent Way Inspector. After this the witness proceeded towards the station while Innasimuthu ran to the Permanent Way Inspector.

The Patrolman, Innasimuthu, who was on duty for the length from Mile 168 (Ariyalur) to Mile 171/6 on the night of the 22nd/23rd November 1956 has stated that at 19 hours he took the night patrol sheet from the station master, Ariyalur, and went towards Kallagam. At Mile 171/6 he exchanged his beat sheet with Nallu Odayar, the night patrolman from Kallagam, took over the white beat sheet from the latter at 21 hours and returned to Ariyalur station at 23-30 hours. When he entered the station, the rain also started. He waited at the station for about an hour and started on his second patrol at 00-30 hours and reached mile 171/6 at 3 hours. Here he exchanged the white beat sheet for the red sheet with the night patrolman Chidambaram Odayar who had come from Kallagam. After about 10 minutes halt he commenced his return journey. During this second beat he noticed at mile 171/3-4 that water was oozing from the ballast and he also noticed that there was slight erosion nearby on the bank. He procured a shovel from the nearest village, made up the eroded bank and boxed up the scattered ballast.

In the statement before the Government Inspector of Railways, which was recorded on the 25th November 1956, the witness stated that he came to the site where the accident had occurred at about 4 hours and sat at the Trichinopoly abutment for about 15 minutes. He noticed water flowing at two feet below the bottom of the girders. He did not notice any erosion or sign of danger to the girder bridge. The flow *was normal as in previous floods.* He arrived at the Ariyalur station at 5-30 hours, *i.e.,* half an hour later than usual as he had to walk cautiously and moreover as the side walk was slushy. The station master asked him at Ariyalur, whether there was any danger to track and the witness said that there was nothing wrong with the track.

In the Statement which the witness made on the 23rd November 1956 (*i.e.,* two days earlier) before the Divisional Engineer he gives the impression that the oozing through the ballast which he noticed at mile 171/3-4 was during his first beat; but he has corrected this in his deposition before the Commission and has stated that this incident occurred during his second beat.

In this Statement before the Divisional Engineer it is recorded that the witness noticed during his return journey in course of the second beat, that the water in the river was flowing one or one and a half foot below the girder level. Before the Government Inspector he had stated that it was two feet below the girder level. The witness professes to be an illiterate man and there cannot be any doubt that this contradictory estimate about the water level is to some extent by approximation. Again in this Statement it is recorded that while returning to Ariyalur during the Second beat, he passed a goods train at 3-30 hours at mile 170/20. This the witness has denied in his deposition before the Commission.

It is also recorded in this statement that while passing mile 168/20-24 he met the Train No. 603 Express (*i.e.,* the ill-fated train) at 5-10 A.M. and when he reached Ariyalur it was about 5-30 hours.

In answer to a question put by the Assessor Mr. Khanna the witness has stated that when he reached Ariyalur at the end of his

second beat it was 5-10 hours. If this is correct then when he reached the station, the train No. 603 had not even reached Ariyalur from the Villupuram side. It is in evidence that the train No. 603 reached Ariyalur at 5-18 hours and left for Kallagam at 5-21 hours. So if Innasimuthu had told the station master at 5-10 A.M. that much water was flowing in the Marudayar and the water was two feet below the girder, the station master would have at least given a warning or caution to the driver even if he had not actually detained the train. It is therefore clear that either the time of 5-10 A.M. as given by the witness in the box or the recorded time of arrival in the beat sheet as 5 hours are incorrect or that the station master had failed to comply with the requirements of rule as embodied in para. 12(b) of the Subsidiary Rules by allowing the train No. 603 to pass without any warning. It may be argued that the station master and the other officers concerned, in order to shift the responsibility from them have induced the patrolman to state both before the Divisional Engineer and the Government Inspector that he arrived at Ariyalur station at 5-30 hours. But I do not think that by such inducement the station master gets any advantage. He will then be accused of violating paragraph 9 of Appendix IV of the Subsidiary Rules. There is also some inconsistency between the evidence of Innasimuthu and the Permanent Way Inspector on the point that Innasimuthu had no direct conversation with the P.W.I. after his return to Ariyalur at the end of the second beat. Innasimuthu has stated before the Commission and he also stated before the Divisional Engineer that he had direct talk with the P.W.I. but the latter has asserted the contrary. As not much turns on this inconsistency, the matter may be allowed to rest here. He has also made contradictory statements about the time of his arrival at Ariyalur station and about the location of train No. 603 at the end of his second beat. Innasimuthu has stated further that he mentioned certain facts before the Government Inspector and omitted some others as he was new to the service and was afraid of being visited with some punishment. During the period of two years when he was patrolling the track at night he had not seen on this river Marudayar such a flood as he did on the day of the accident. He saw the water flowing about two or two and a half feet below the girder of the bridge. On being interrogated as to what was meant by "High flood level" the witness has stated that he has been taught that after the accident. The witness can see only at arm's length with the signal lamp supplied to him.

Chidambara Odayar, the night patrolman from Kallagam has stated that he started on his beat at 00-00 hours from Kallagam, and reached mile 171/6 at about 3 hours on 23rd November 1956 and took the patrol sheet from Innasimuthu and returned to Kallagam at 6 hours. There was moderate rain when he started from Kallagam at 00-00 hours and when he came to mile 171/6, it was drizzling and when he returned to Sillakudi Halt the rain had stopped. There was no rain after this. The witness met three trains coming from Ariyalur at miles 176, 173/3-4, and 172 while proceeding from Kallagam.

Although the witness had stated before the Government Inspector that when he met Innasimuthu at mile 171/6 the latter told him that the track was alright, in course of his cross-examination he

stated that Innasimuthu did not tell him anything. He has stated further in course of cross-examination that during his night patrol he was not accustomed to meet the Permanent Way Inspector or the Assistant Permanent Way Inspector.

Nalla Odayar, the other patrolman from Kallagam who had exchanged patrol sheets with Innasimuthu during the latter's first beat at 9 P.M. at mile 171/6 has stated that during his beat there was no rain and he did not ask Innasimuthu anything.

Chinnapa Padayachi, the Gangmate of Gang No. 8, Ariyalur section has stated that during his eight years of service the highest flood level that he noticed in the river Marudayar was up to seven feet below the girder. When he went to the spot of the accident at 7-30 A.M. on 23rd November 1956 he found that the water level was about six inches below the bottom of the girder.

P. S. Nataraja Iyer, the Superintending Engineer, P.W.D., Tanjore Circle, who was deputed by the Commission to inspect the Marudayar basin has stated that the Marudayar Minor Basin is a part of the Coleroon North Main basin. Its drainage area lies in the taluks of Perambalur and Udayarpalayam. There are 11 P.W.D. tanks situated in this portion of the basin lying in Perambalur Taluk and 23 minor irrigation sources of which 4 are river-fed channels and the rest are minor irrigation tanks, of which eight breached due to the rains on the 22nd and 23rd November 1956. In addition five more drinking water or bathing ponds also breached on those days. There was heavy rain during 11 P.M. and 4 A.M. on the 22nd/23rd November 1956 and about 3 inches of rain fell during this period. The intensity of this rainfall resulted in a run off of about 0·3" to 0·4" per hour at least from about 3/4th of the catchment area and brought about the heavy flood that resulted in the accident at the railway bridge. As regards the breaches of the 13 tanks the evidence of the witness is that the cumulative effect of the discharge from the 13 tanks would not have been more than 1900 cusecs, and it can be said that this contribution of 1900 cusecs to the very heavy flood discharge realised near the bridge site in the Marudayar river would not have materially contributed to the actual havoc that occurred, as it is less than 1/8th of the flood discharge of 16,000 cusecs said to have occurred in 1937. The witness has pointed out that the total rainfall in November 1956 was 10·55 inches against a maximum of 18·10 in 1940 and 16·10 in 1937. But although the incidence of rainfall has not been more than the maximum realised in that month in previous years, the continuous rainfall previous to the date of occurrence of the accident, when already the catchment had been wet, coupled with the heavy rainfall for about 5 hours on the 22nd/23rd November 1956 brought about the abnormal flood which caused the breach near the southern abutment and resulted in the accident. This appears to be the nett effect of the evidence of the Superintending Engineer.

Mr. A. R. Narayana Rao, the Chief Operating Engineer, Madras Electricity Department, who had made certain suggestions in letters addressed to the Commission was requested to give evidence and accordingly he appeared and deposed before the Commission. He has stated that the discharge in a waterway was dependent on the

type of soil in the catchment and rainfall intensity. The engineering profession had adopted some empirical formula for estimating the quantity. This formula adopted a co-efficient which was fixed for a particular type of catchment. This co-efficient varied from about 450 to 3,000 depending upon the track. In very hilly tracts they had estimated sometimes 3,000 which meant that rain water was allowed to run away to the draining rivers in a greater proportion. Supposing 100 gallons of water fell in five minutes in a particular area, if it was rocky, probably 99·9 gallons would go away into the river. If it was sandy soil most of it might be absorbed and the run off would be less.

In the catchment of the Marudayar basin, the thirstiness of the soil had been reduced by the previous continuous rainfall for a long period and the earth had become sodden and saturated with water. This approximated to the condition of rocky and hilly country and if the maximum discharge at this place was about 12,000 it had become suddenly 50,000; its co-efficient had changed on the particular night. The theory of the witness as to the cause of the disaster is that the flood water that had headed up on either side of the railway embankment on the upstream side tried to rush back into the river and during that process there had been under-currents which could not be observed from the top, but which must have burrowed or eroded the bank. This happened when the floods receded and not when they were rising. According to the witness no amount of patrolling would have been able to avert an accident caused by such a process.

The witness has also made some suggestions about safeguards to be adopted in order to prevent similar accidents in future. He has suggested that there should be periodical check of the co-efficients by appointing a Committee of Engineers. The second suggestion is to carry the track on either end of the bridge on a concrete pile trestle. This device has been described by the witness in some detail but it is not necessary to set it out at length in this part of the report. The other suggestions are intensive patrolling and the installation of a Semaphore signal operated by a concrete float near about the bridge side.

C. A. Murenthor, employee of a private electricity distributing Company in Chidambaram, who had also submitted to the Commission a sketch of his invention of a train protector was asked to appear before the Commission and give evidence. He explained the device as a sort of pilot car which will run in front of the engine at a distance of about a furlong driven by power generated from a motor and whenever it met with any obstruction it would cause a siren to sound thus warning the engine driver of the danger. But as this device exists only in the imagination of the witness and no such device has been manufactured or demonstrated as yet, mere submission of a sketch is of no use to the Commission.

These are all the witnesses who have deposed before the Commission. On behalf of the intervening parties certain lists of witnesses had been submitted but ultimately it was thought that no useful purpose would be served by calling these witnesses as their

evidence would not be of much assistance in throwing light on matters which form the subject matter of this Inquiry.

It is thus clear from the material or evidence on record that there was heavy rain on the night of the 20th November 1956 at Ariyalur. The rainfall recorded was 3·75 inches. There was some rain on 21st November also. The rainfall on 22nd November 1956 was also heavy. The record of rainfall on 22nd/23rd November 1956 is 3·75 inches.

At Perambalur from where the Marudayar river originates, about 4·02 inches of rainfall was recorded on 22nd/23rd November 1956. The statistics of rainfall as supplied by the Revenue officers show that for the last three or four months there had been considerable rainfall in Perambalur and Ariyalur areas. The Superintending Engineer, Mr. Nataraja Iyer also confirms this.

There cannot therefore be any doubt that there was considerable discharge of rain water in the catchment area of the Marudayar river and there was considerable accumulation of water in the irrigation tanks in the area and there must have been swelling in the flow of water in the river channel due to such rain.

Although it is suggested by the Railway administration that such rainfalls as were experienced on the 20th November 1956 and 22nd/23rd November 1956 were not uncommon for the Marudayar basin and therefore there was nothing to forebode an unprecedented rising of the water level in the river or to forebode the onset of heavy floods in and around the catchment area, one is inclined to feel from the past records of rainfalls in the Perambalur and the Ariyalur areas, that heavy discharge of rain water and consequent rising of the water level in the tanks and in the Marudayar river is not an unknown thing in such areas. One also feels disposed to come to the conclusion from the records of heavy rainfall of the years 1930, 1936, 1941, 1943, 1946, 1951 and especially of 1955 that the river Marudayar had probably experienced some flood in such years although no record of any such flood appears to have been kept. This conclusion is strengthened by the fact that in the year 1937 in which the highest flood level was recorded, the record of rainfall is less than that recorded in the years to which I have made reference. It is possible that the floods of the 23rd November 1956 had due to some unknown factors assumed proportions which had exceeded all past records, but I am unable to find any justification for the Railway authorities in not concentrating their attention on this Bridge No. 252 and in not taking steps for the strengthening of the abutments, and the approaches of the bridge and the embankments lying beyond. It is true that the water flow of the river had in the past disclosed an uniform tendency to press the north bank of the river and the northern abutment of the bridge, and in order to prevent erosion or scouring of the bank, stone pitching was provided in 1942 and certain repairs were also carried out to the pitching on the northern abutment in 1943-44 but the fact remains that three spans towards the southern abutment had become silted up, with the result that in case of overflow of the river bed due to flood, there would be a normal tendency of the flood waters to scour or erode the southern bank or margin of the river near the southern abutment,

as the last three spans would not provide a sufficient outlet. So a rivetment of a portion of this southern bank near the south abutment of the bridge might have prevented the disaster of the 23rd November 1956. It must however be admitted in fairness to the Railway administration that it is also just possible that in spite of all this precaution as to rivetment or other protective works taken, the accident would have happened all the same, owing to the enormity of the flood waters which flowed cross country by reason of the spill which took place on the upstream bend of the river and which drained itself in the Marudayar near the southern embankment, and also by reason of the breaches in the 13 irrigation tanks and ponds in the catchment area. But when there is scope for improvement and scope for providing greater security for the bridge and its approaches, and thereby ensuring greater safety for the passengers, I find it difficult to exculpate the Engineers of the Railway administration of the charge of indifference and inaction which has been brought against them.

It further appears from the report of the Railway Board for the year 1952-53 Vol. I page 43 that in the Villupuram-Trichinopoly and Trichinopoly-Manamadura Sections there were extensive damages caused to the track, station buildings, staff quarters etc. due to severe cyclone accompanied by heavy rain on 30th November 1952. The section particularly affected was between Ariyalur and Chettinad and the approximate cost of repairing the damages came up to Rs. 1,25,000.

Similarly from the Report of the Railway Board for the year 1954-55 Vol. I, page 51 it appears that in the Vriddhachalam section, due to heavy floods in the Gadilam river, the banks on both sides of bridge No. 75 were badly damaged on 21st October 1954 and the approximate cost of repairing the damage was Rs. 6,400.

It further appears from the said Report of the Railway Board for the year 1954-55 Vol. I, page 101 that accidents due to flooding of permanent way during 1953-54 and 1954-55 were 61 and 147 respectively.

The Railway Board as pointed out before, on 2nd December 1954, issued a Circular No. 54/W/10/31 to the General Managers of all Railways inviting their attention to Chapters X and XI of the Way and Works Manual and insisting on meticulous observation of the rules laid down there.

The Deputy Chief Engineers or the Regional Engineers were directed to personally inspect all bridges having a past history as well as others considered necessary, and to satisfy themselves that the bridges are in safe condition and likely to remain so under flood conditions and to record the results of their inspection in the Bridge Inspection Registers.

The Engineers were also directed to give written instructions as to steps to be taken regarding High Flood levels for bridges likely to be affected and how to deal with trains if safe High Flood levels were exceeded.

It appears that as a result of this direction and circular bridges were inspected but it was thought that the Marudayar bridge did not need any special attention. Some witnesses have considered the bridge as an unimportant bridge and some have been forced to admit under the stress of cross-examination that this bridge should also be considered as an important bridge. However one finds it difficult to follow why in spite of the heavy floods of 1937 and the minor floods of subsequent years which necessitated groyne to be built and pitching and repair works to be done on the northern bank, and why in spite of the fact that portion of the southern embankment beyond 500 feet of the southern abutment had suffered breach and necessitated rivetment to the extent of 400 feet, in 1941, no attempt was made to strengthen the southern bank in anticipation of likely danger to that side of the bank in case of heavy flood in future years.

It may be that since the right bank was not seriously or materially affected in any previous flood the Engineers did not feel justified in incurring unnecessary expense for strengthening this bank. But finding that in the Hyderabad railway accident in 1954, the collapse of the bridge was the cause of the accident and in 1956 in the Mahboobnagar accident, there was also collapse of the bridge, was it proper or reasonable for the Engineers, especially in the face of repeated cautions given by the Railway Board, to put the question of economy in the forefront and relegate the question of safety of the passengers to a place of secondary importance? I am unable to answer this question in the affirmative.

It appears to me that having regard to the past history of the bridge the Engineers should have concentrated their attention on and should have been more careful about this bridge, and its approaches.

But as I have pointed out already, it is problematic whether even timely construction of rivetment or other protective works at or around the southern abutment would have been enough to prevent the erosion and avert the accident. The whole thing rests in the region of conjecture. It will, therefore, be a rash conclusion to fix definitely the responsibility for this accident on the Engineering department of the Railway. It may be that the protective works would have withstood the onslaught of the floods and would have saved the approaches and the abutment from being scoured or eroded, or the case might have been otherwise, and notwithstanding all such precautions taken, the accident would have happened. So although I condemn strongly the attitude of indifference and inaction on the part of the Engineers concerned, I am unable to assert with certainty that they are responsible for the accident in question.

The next question is whether any other person can be held responsible for this accident of the 23rd November 1956. It has been argued that the patrolman on seeing that the river Marudayar was in high flood and that the water level had risen about two feet below the girder, should have stationed himself at the bridge and stopped the train No. 603, or should have cautioned the driver, and if this had been done the accident would have been averted.

Now the rules of the Railway Administration require that every railway servant whether supplied or not with a copy or translation

of the rules relating to his duties, shall make himself acquainted with such rules, and the Railway Administration shall ensure that he does so.

It is also a general rule of the Railway Administration that every railway servant who observes any unusual circumstances likely to interfere with the safe running of trains or the safety of the public, shall take immediate steps, such as the circumstances of the case may demand, to prevent accident, and where necessary advise the nearest station master by the quickest possible means.

One of the duties of Permanent Way Inspectors is to see that each patrolman is instructed in the rules referring to the duties he has to perform, and understands them. The Permanent Way Inspector, Mr. Soundararajan has deposed that Innasimuthu was selected for patrolling duties, for his smartness, and alertness, his knowledge of rules and literacy. Although Innasimuthu has tried to give the impression in course of his deposition before the Commission that he is an illiterate person, he has admitted in the box and it is clear from the various answers that he gave to the questions put by the Government Inspector, that he is conversant with the rules pertaining to his duties. His answers to the Government Inspector's questions are the answers of an intelligent patrolman. He has stated that although he saw water flowing at two feet below the girders he did not consider it as anything unusual, as this was a normal flow of water under heavy rains.

The Chief Engineer has stated that when the water level in a river rises it is a sign for the patrolman to apprehend danger and he has stated further that if a patrolman is apprehensive of danger, he either stops the train or allows the train to pass slowly. The Chief Engineer has made it clear that he expects the patrolman to take immediate action or to take caution.

In answer to a question put by Mr. Venkatachari (Assessor) the Chief Engineer has stated that the patrolman failed in his duty, and if he had done his duty the accident would have been avoided.

In answer to a question put by Mr. Khanna to the following effect:—"In this case the patrolman definitely should have taken action in stopping the train and not left the spot of the bridge when he found that water was reaching the level of the girder", the Chief Engineer answered in the affirmative.

It is thus clear that in the opinion of the Chief Engineer, the accident could have been averted if the patrolman had done his duty.

Reliance has also been placed by Counsel Mr. Srikumar on Paragraph 12 (a) in Appendix IV of the Subsidiary Rules of the South Indian Railway and it is suggested that the patrolman violated this rule. This rule, however, does not literally apply to the case of an ordinary night patrolman. It purports to lay down the duties of a Gang Maistry.

The rules which deal specifically with the duties of Patrolmen are paragraphs 1706, 1713 and 1714 of the Way and Works Manual.

Paragraph *1713* (*b*) is as follows:—

"Apprehend damage to line when—

(i) the flood is higher than any previous flood or is within 4 feet of rail level or is touching a girder or nearly touching it;

(ii) the water on one side of the embankment is at a much higher level than on the other side.

Paragraph *1713* (*c*) is as follows:—

"Take immediate steps in accordance with paragraph 1714 to stop trains when any portion of the line is likely to be rendered unsafe or rendered unsafe due to abnormal rain or flood or any other cause."

It appears to me that these rules support the opinion expressed by the Chief Engineer and having regard to the contradictory statements of the patrolman that he noticed the water flowing at two feet or one and a half feet or one foot below the girder level it must be held that he failed to discharge his duties properly, and if he had not failed in his duty the accident might have been averted. Innasimuthu has stated no doubt that he was not aware of the significance of the previous flood level mark before the accident and that the flow was normal as in previous floods. But this is hardly acceptable. This witness has contradicted himself on several points, and the fact that immediately after reaching Ariyalur he was busy in communicating the news about the water level to the P.W.I., and A.P.W.I. indicates that something unusual had happened. In my view Innasimuthu has been taught to pretend ignorance about the high flood level mark of 1937 as indicated on the bridge No. 252, in order to get out of the mischief of the rule in Paragraph 1713 (b) (i) of the Way and Works Manual. The poor patrolman has been made a tool in the hands of others and he has been induced to make all sorts of contradictory statements from time to time with a view to shield himself and to shield others. It is possible that in the darkness of the night it was not feasible for the patrolman with the hand signal lamp in his hand to notice exactly whether the flood level was one foot or two feet below the girder or it had risen higher than the previous flood level, but if he was in any doubt there was all the more reason for his remaining on the spot and stopping any approaching train or at least giving caution to the driver of the approaching train.

The question of the responsibility of the Station Master may now be considered. It appears that Vincent Raj, the Relieving Assistant Station Master was on duty at the Ariyalur Station between 21.30 hours and 6.00 hours on the 22nd/23rd November 1956. The train No. 603 reached Ariyalur at 5.18 hours and left for Kallagam at 5.21 hours. The patrolman Innasimuthu did not arrive at the Ariyalur station at the end of his second beat until 5.30 hours. Therefore he did not return within the scheduled time.

Now under paragraph 9 of Appendix IV of the Subsidiary Rules of the South Indian Railway, if a patrolman does not report at the time at which he is due, the station master of a station on a beat section shall at once warn the nearest Permanent Way Inspector and

Sub-Inspector by wire and send a written message to the nearest Gang Maistry instructing him to proceed along the line to ascertain the cause of his absence and to arrange for a substitute, and until one of the station masters of the beat section receives definite advice as to what the delay is due to, the Drivers of both Up and Down trains shall be given a caution order as laid down in Rule 325 or 368.

Although the patrolman Innasimuthu did not arrive at Ariyalur at 5 hours which was the scheduled time, the Assistant Station Master, Ariyalur, did not act according to Paragraph 9 of the Appendix IV and did not issue any caution order to the driver of the Tuticorin Express (Train No. 603) which left Ariyalur at 5.21 hours. Thus the station master also failed in his duty. What would have been the effect of issuing a caution order to the driver of Train No. 603 cannot be asserted with any degree of certainty. It might or might not have averted the accident but the fact remains that the Station Master was guilty of remissness of duty in acting in contravention of the rule embodied in Paragraph 9. Now if on the other hand the patrolman had reached Ariyalur at 5 A.M. or 5.10 A.M. and had told the Assistant Station Master anything about the high flood in the river Marudayar, this Station Master was equally guilty of dereliction of duty by not conforming to the Rule in Paragraph 12(b) in Appendix IV of the Subsidiary Rules which enjoins that the Station Master on receiving information of high flood at a bridge shall warn drivers of trains subsequently entering the section by means of a caution order as laid down in Rule 325 or 368. I have no doubt that Innasimuthu informed the Assistant Station Master as well as the Permanent Way Inspector that much water was flowing in the river, though it is suggested that the only conversation between the Patrolman and the Station Master was whether there was danger to the track.

It has been suggested that the Assistant Engineers, Permanent Way Inspectors and the gangmen in charge of inspection and patrolling of this section of the railway are also to blame for this accident. The rules of inspection and patrolling as laid down in the Indian Railway Way & Works Manual in Chapters II, V, XI and XIV have been brought to our notice. It is argued by Mr. Nambiar that Rule 1425 of Chapter XIV was not observed. The evidence of Sundara Rao the Divisional Engineer is that he did consult the existing list of vulnerable points and found that no addition or correction of the list was necessary but the impression that he and Mr. Samiulla gave in the box is that the spirit of this Rule was not observed by these two Engineers. It appears to me that the two Engineers did not apply their mind to this aspect of the matter and Mr. Nambiar's argument has considerable force. Mr. Nambiar also urged that rules 1101 and 1102 of the Way & Works Manual have also been violated. But there is no clear evidence that the railway section in question is liable to be flooded or breached, in the sense, that floods are of frequent occurrence in this river. No record of floods in this river is available except that in 1937 there was heavy flood. Moreover this bridge was not considered an important bridge, though it may be that there was no real justification for such assumption. Having regard to all these matters it will not be proper for me to make any definite assertion that the Engineers Sundara Rao and Samiulla are guilty of breaches of these Rules 1101 or 1102.

Mr. Nambiar also drew attention to Rule 1104 of Way & Works Manual and complained that this rule had also been ignored by the Assistant Engineers, and other persons mentioned in the Rule. But there is no clear evidence that there had been any flood existing or subsisting in the area as to call for action under this rule. The evidence is that there was sudden onrush of flood water on the night of 22nd/23rd November. If this be the true state of affairs then the Engineers and Inspectors cannot be said to have violated this Rule. Although personally speaking, I find it difficult to believe that there was no flood water at all before the night of 22nd/23rd November 1956 in the river Marudayar or in the surrounding areas, in the absence of any evidence on the point, I am unable to find that Rule 1104 has been violated. But I feel constrained to observe that the Permanent Way Inspector's (Mr. Soundararajan's) and his Assistant's conduct as exposed by the evidence of Innasimuthu, shows an utter lack of the sense of responsibility which attaches to the offices they were holding at the time. It was raining heavily since 11 P.M. if not earlier and he and his Assistant did not think it worthwhile to be on the alert knowing full well that weather conditions were uncertain.

It has been also suggested that if the driver of the Engine attached to the ill-fated train had not run the train at full speed the accident could have been averted. But this is again a matter of conjecture or surmise. It is clear from the evidence on record that there was no speed restriction so far as this section was concerned. The train was running late. The driver apparently scented no danger to the railway track and so he perhaps drove at the usual speed of 35 or 40 miles per hour. If he had scented any danger, he would, at least to save his own life, if for nothing else, have resorted to cautious driving and would have brought down the speed of the train in proper time. It is, however, quite possible that if the train had run at the time of the accident at a lower speed, the loss of human lives and damage to the rolling stock would have been much less and the accident would not have been so serious as it turned out to be. But as no danger was apprehended the driver did not take any precaution.

With regard to the cause of the accident, my finding is that unprecedented and unforeseen flood in the river Marudayar and in the areas around the embankments of the river, caused erosion or scour under and around the southern abutment of the bridge No. 252 and its approach, and when the Express Train No. 603 reached the spot of the accident, seventy feet of the approach to the bridge beyond the southern abutment, collapsed or had already collapsed, due to this scour or erosion, and this resulted in the accident.

Some points have been made that the accident was due to defective design and construction of the bridge and its abutments or was due to the bridge being constructed at a site which was not suitable, but it appears to me on the evidence as placed before the Commission that there is no substance in these points. These aspects of the matter, therefore, need not be considered any further.

The following safeguards are suggested for prevention of similar accidents in future:—

(a) The foundations of abutments of bridges resting on screw piles should be strengthened and construction of rivetments or pitching of the river banks or margins on either

side of the abutments to a sufficient length, should be at once undertaken.

(b) The rules in Chapters X, XI, XIV and XVII of the Indian Railway Way & Works Manual should be rigidly observed and mere nominal compliance should be avoided. Engineers and Inspectors should be instructed to explain the rules to the staff before and during the monsoon each year.

(c) On sections where Railway quarters are not provided to patrolmen, at least two patrollers should be appointed for each beat from experienced gangmen specially trained for the purpose.

(d) The length of beat of patrollers should not exceed three miles.

(e) Night patrolmen should have as part of their equipments a strong electric torch to enable them to observe the level of water and the strength of current flowing through the bridges or along the abutments.

(f) Patrollers should be trained to take soundings, probings near abutments and piers to determine the depth of scour in order to decide whether trains should be slowed down or stopped and piloted over the danger point, and the selection of men for this work should be from people who can usefully function in this manner.

(g) Stationary watchmen should be posted at the bridge during floods or heavy rainfall whether there is imminent danger to the bridge or not, until the flood water subsides and the water reaches the normal level.

(h) In case of doubt the patrolman should not allow trains to pass over bridges when the river is flowing at high velocity.

(i) Signboards should be put up at either end of the bridges at adequate distance from the bridge.

(j) The speed limit of the train should be restricted to 5 to 10 miles per hour over bridges whenever there is rise in the level or increase in the flow of water during monsoon.

(k) Good glass should be fitted to the YP Engines to make it possible for the drivers to see through the glass at a distance especially during rains.

(l) Daily water reading should be taken at all important bridges during the monsoon and the Register should be available for perusal by the Superior Engineering staff, at any time. The staff should be properly trained for the purpose.

(m) The rules in Chapters X and XI of the Way & Works Manual should be amplified to include an appendix on river training and control of big and small rivers and indications to be looked for future trouble clearly described and explained. The Railway Assistant Engineers and

District Engineers should undergo a short course on this and also visit river model research stations to acquaint themselves with the behaviour of rivers and their response to training works.

(n) The High Flood level mark should be prominently marked on every bridge and a danger level mark below High Flood level should be fixed by the Engineering authority and marked in *red*. When the level is exceeded, the patrolman should be prepared to stop trains and pilot them if necessary.

(o) Passenger trains should carry portable telephone instruments so that they can communicate with the nearest Railway Station in the event of trains being halted between stations by patrolmen.

The Report of the learned Assessors is annexed hereto and marked "A".

Mr. V. T. Rangaswami Iyengar appeared for the Southern Railway. Mr. C. A. Vaidyalingam, Government Pleader appeared as *amicus Curiae*. Mr. K. Anandan Nambiar, M.P., and Mr. T. S. Ramaswami Aiyar, Advocate, representing the Madras Advocates' Association and Mr. V. C. Srikumar representing Mr. Ganesan, a passenger in the ill-fated train, intervened and cross-examined the witnesses.

In conclusion I should like to express my gratitude to the Hon'ble the Chief Justice of the Madras High Court for giving us the use of a court room in the Madras High Court building for holding the sittings of the Commission. I and my colleagues (the learned assessors) also express our thanks to all the Counsel concerned and to Mr. Nambiar and to the staff for their very valuable assistance and co-operation. We also thank the learned Registrar of the Madras High Court and his staff for the excellent arrangements made by them for accommodating the press and the public and for maintaining order and discipline in the Court room. Lastly we thank the representatives of the Press for publishing detailed notes of the depositions of witnesses from day to day and thus rendering very useful assistance to the Commission.

H. K. BOSE,

8th January, 1957.

Judge, High Court,
Calcutta.

ANNEXURE "A"

REPORT OF TECHNICAL ASSESSORS ON THE ACCIDENT TO NO. 603 TUTICORIN EXPRESS ON 23-11-1956 NEAR ARIYALUR

1. Description of Accident

Train No. 603 Down Madras Egmore-Tuticorin Express arrived at Ariyalur (Mile 168) on Villupuram-Trichinopoly Chord Line at 5·18 hours on 23rd November 1956 and left for Kallagam station at 5·21 hours, 1 hour and 21 minutes late. The train with 12 bogies was being hauled by engine No. YP. 2069. After crossing bridge No. 252 (8 spans of 62'-3" girders) at Mile 170/10-14 over the Marudayar river, it met with a serious accident involving heavy casualties. The engine plunged into a breach caused by heavy floods behind the South abutment and came to rest 70 feet away with its tender standing upright. The first 6 coaches also fell into the breach and were completely smashed. The seventh coach had one end resting on the bridge and the other end down in the river. The eighth was on the bridge with the front wheels derailed. The remaining four carriages were unaffected by the accident.

2. Alignment and grade

The general direction of the line between Ariyalur and Kallagam is North to South, but at the accident spot the line runs North-East to South-West. The alignment passes through generally flat country with Ariyalur station (Mile 168) on one side and Sillakkudi Train Halt (Mile 172¼) Kallagam station (Mile 177¾) at the other side of the bridge with mostly down grade from Ariyalur to the bridge. At the bridge site and on either side of it for about 800 ft. the track is level. Beyond this, there is an upgrade followed again by a level section. The formation on either side of the bridge is in embankment 10 to 12 ft. high. The soil at Ariyalur end is mostly clay and at Trichinopoly end clay mixed with sand. There are two curves 2° each on either side of the bridge but well away from it. The track consists of 60 lbs. flat footed rails laid on N plus 2 steel sleepers.

3. The river course and its catchment area

The Marudayar river has its source nearly 25 miles to the West of the Railway line in the Kurumbalur Hills. The area of the basin is nearly 150 sq. miles. A number of tributaries join the river mostly to East of the Trunk Road from Madras to Trichinopoly. The soil in the lower portion of the catchment is mostly sand mixed with red or blackish clay and is mostly cultivated with crops, the lower reaches being densely cultivated. The river crosses the Railway bridge at right angle but upstream of it, it has two bends. The upper bend comes as close as 2 furlongs near Mile 171/3 of the Railway line. The general effect of these bends on the bridge is that the deep course hits at the Ariyalur or concave side and the shallow and the silted course is at Trichinopoly end of the bridge. The deep stream is more or less confined to spans 1 to 4.

4. Weather and rain fall

The average rain fall in Odayarpalayam and Perambalur Taluks of Trichinopoly District, where this basin lies, is 39" about 19" of

which falling in North East monsoon months September to December. Cyclones do occur in this monsoon but rarely. Floods are not frequent. There is a road bridge of 10 spans of 30', with R.C.C. decking, 2 miles below the Railway bridge. Two of the piers of this bridge next to the abutment at the left were also washed away by the same flood on the day of the accident.

5. **Design of the bridge**

(i) Bridge No. 252 consists of 8 spans of 62'-3" on piers made up of two cast iron screw piles 3 ft. in diameter and held together by cross bracing to a depth of about 60 ft. There are girder stools over the piles carrying a cross girder over which the main girders about 6 ft. deep rest.

(ii) The abutments consist of U-shaped R.C.C. boxes with R.C. cross ties and return walls. The abutments rest on cross girder over two cast iron screw piles at each end while the extreme ends of the two return walls rest on timber piles. The bottom is open and is above the bed level of the river. The earth filling below the bottom is retained by stone pitching to a slope of 1½ to 1.

6. **History of the bridge**

(i) After the construction of the bridge and before the line was opened, the need for pitching the abutment on the Ariyalur side was felt as the river was found eroding the bank. Orders regarding pitching are found in a letter dated 10th October, 1928 stating that the pitching should be taken "down to the river-bed as the river is cutting into the north bank." Nothing is mentioned about the south bank, but as both revetments are referred to in an earlier communication and plan, it is to be presumed that it was built to the same specification on both the approach banks. No detailed plan of the pitching on the north or south abutments is available. These works must have been carried out before the inspection of the line by the Senior Government Inspector of Railways. While inspecting the line on 22nd January 1929 and passing the line for opening, the Senior Government Inspector of Railways, Col. F. R. H. Eustace wrote about the bridges as follows:—

" * * * * *

5. Bridging is heavy and is mostly built in good stone. There are on this section 47 spans of 62¼ ft. on C.I. cylinders similar to those previously built and described in the reports of other sections of this chord. This type appears suitable for this locality where waterway has not been restricted and where scour is not deep. Scour will have to be watched in the Manimukta Nadi at mile 34·59 where the cylinders are only sunk 27 feet.

6. Waterway provided appears generally sufficient. The recent monsoon was a heavy one but has caused no trouble."

(ii) This state of affairs continued till 1937 when a small shallow erosion was noticed on the Trichinopoly side embankment well away from the bridge. Based on the experience of 1937 floods and perhaps also later floods, initiative was taken in 1941 to provide a revetment at this place about 4 feet high. The work was actually executed in

1944-45. On the Ariyalur side the pitching was strengthened and a new revetted guide bund was added 75 feet long on the upstream side of the bridge. Since the construction of the bridge, while the pitching on the Ariyalur side and river-bed was gradually getting eroded and being repaired from time to time, the river-bed in spans 5, 6, 7 and 8 had silted over the original bed levels to varying depths, being about a foot near the south abutment and a little higher in the inside spans.

(iii) Except for the 1937 flood, no record had been maintained of any floods in this river till the time of the present flood (1956). No other damage to the bridge and its embankments had been reported at any time of its history. The same conditions appear to have prevailed up to the time of the present flood.

(iv) A register of inspection of bridges has been maintained in regard to this bridge and the bridge inspected in accordance with the rules in force.

7. **Patrolling during monsoon**

(i) During the North-East Monsoon months from 1st October to 15th January, the Villupuram-Trichinopoly chord line is patrolled at night. Each block section is divided into 2 or 3 patrol beats. Between Ariyalur and Kallagam, where the accident occurred, there are 3 patrolmen, one from Ariyalur to Mile 171/6 (2½ miles) and two from there to Kallagam (5 miles). Each patrolman carries a sheet and exchanges it with his opposite number at the junction of the beats, the sheets themselves being signed by the Station Masters at either end both when he leaves and arrives.

(ii) The Ariyalur beat patrolman is scheduled to leave at 19.00 hours and return at 23.30 hours on the first round and leave at 0.30 hours and arrive at about 5.00 hours on the second round. Bridge No. 252 where the accident took place lies in this beat.

8. **Analysis of the conditions prior to and after the accident**

(1) *Weather conditions.*—There was a weather warning on 19th November 1956 "locally heavy rain in your area next 48 hours". Besides this, Station Master, Agastyampalli, (near Point Calimere, south of Negapatam Port) wired on 19th November 1956—"Heavy rain and wind from 7 hours—Suspect cyclone like last year". These weather conditions had disappeared by 21st evening and after that there was no prior warning relative to the rainfall which occurred in the area on 22/23rd night.

(2) *The rainfall.*—The rainfall in the two stations Perambalur and Ariyalur in or near the basin of the Marudayar was very heavy in 1956, the total in the months August to November including the date of accident was 35·7″ in Perambalur and 45·4″ in Ariyalur. The total for the two stations was 81·1 inches, the highest in 17 years according to the Revenue Divisional Officer, Ariyalur, and highest for at least 30 years according to other records. The rainfall recorded on 22/23rd night in the two stations was 4·25″ in Perambalur and 3·75″ in Ariyalur. These falls were preceded by heavy rains on

20th November 1956—2·65″ at Perambalur and 3·75″ at Ariyalur. About 0·3″ per day fell on 21st and 22nd in the two stations. A very peculiar feature of the rainfall prior to the floods on 23rd was that most of it fell between 11 P.M. and 4 A.M. on 22/23rd night giving an average intensity of rainfall of about 0·7″ per hour and a peak intensity of perhaps 1·5″ per hour at each of the two stations.

(3) *River catchment and floods.*—(i) Prior to the flood on 22/23rd night, according to revenue officials, all tanks in the basin were full and surplussing. There are 11 P.W.D. tanks situated in this portion of the basin lying in Perambalur taluk, and 23 minor irrigation sources, of which, 4 are river-fed channels and the rest M.I. (minor irrigation) tanks. The Superintending Engineer, P.W.D. who investigated the matter has reported as follows:—

> "Of these M.I. tanks, 8 breached due to the rains on the 22nd and 23rd November 1956. In addition 5 more drinking water or bathing ponds also breached on those days. The sum total of discharges from all the 13 breached tanks works out to 4342 cusecs of which 545 cusecs should be ignored as that is from the Thimmoor Nadu Eri, which had breached into the lower Thimmoor Periakoil Eri which latter alone had contributed to the flood in the stream above the Railway crossing. The resulting discharge of 3797 cusecs is an instantaneous one and based on the assumption that all the tanks breached at the same time and the breached flow had a direct route without spreading over the adjoining country and reached the accident site simultaneously. This would not have actually occurred in practice, as there are no direct connecting channels for conveying the discharge from the breaches with their undiminished velocity right to the bridge site all at the same time when the distance of the individual tanks and ponds from the breached site varies between 1 and 10 miles. There is the moderating effect of distance and the nature of intervening catchment to be reckoned with, as the breached water has to spread over the intervening country and flow towards the stream near the Railway bridge. The cumulative effect of this discharge even under the most exacting conditions would not have been more than 1,900 cusecs."

This contribution of 1,900 cusecs to the peak flood discharge realised near the railway bridge site in the Marudayar river is of little significance giving only 3·8 per cent. if the peak discharge is assumed at the figure given by the Railway.

(ii) No daily water levels of the river during monsoon are recorded by the Railway at the bridge. The river flow is comparatively small for most part of the year and there are no reports of high floods in railway records in any year except that on 19th November 1937 when the river floods rose to a height of 1′-9″ below girder level.

(iii) There is no clear evidence as to the state of the river on the evening of the 22nd but the level should have been so low as not to attract notice.

(iv) Night patrolman Innasimuthu passed the accident spot four times during the course of the night at approximately the following hours:—

20.15; 21.45, 2.00 and 4.00 hours.

According to his statement, recorded by the District Engineer, the water level at the bridge site was 5 ft. below girder level at 21.45 hours, 3 ft. below girder level at 2 hours and 2 ft. below girder level at 4 hours.

(v) These levels are admittedly approximate. According to him the levels did not indicate the need for any action by him.

(vi) There is no evidence of water having overflowed the embankment beyond the breach site near the south abutment. The water mark on the girders on the Ariyalur side definitely showed the pissibility of its being somewhere above the bottom of the girders. Judging from this and the flood flow of the river at the point opposite 171/3 it is possible that the flood levels against the south embankment were somewhat higher than those at the Ariyalur side of the river.

(vii) After the accident, the Guard noticed the water level just touching the girder on the upstream side of the bridge near the accident spot. This level was maintained for a short time after which the river began to fall.

9. **Cause of the accident**

Evidence on record and the plans furnished to us show that after the accident a scour was noticed round the south abutment and hugging it. The greatest depth of this scour was about 23 ft. below the rail level of 205 giving a level of about 182. All the pitching in this region had been completely washed away leaving a scour at the edge. A breach across the embankment immediately to the south of the south abutment 70 ft. long was noticed with the engine and the carriages lying in it as already described. The scour was seen to include the abutment and span 8 and portion of 7, but the rest of the river-bed in spans 6 and 7 was left unaffected. The direction and shape of this scour suggest that it was caused by a strong whirl at the toe of the pitching on the upstream side of the south abutment. At the time the last train passed over this section no jerk or rough riding was observed and the train went through without any accident. This was at about 3.10 hours. Prior to this, five trains, Expresses and Passenger, had passed over the bridge between the hours 22.30 and 3.10 on the night of 22/23rd November 1956. With the increase of floods in the river which must have produced also a greater spill over the margins of the river opposite 171/3, currents some parallel and some at an angle to the south embankment must have been induced and the discharges flowing down these spill channels in the very high stages of flood flow must have brought about a swirl and the toe erosion induced before the accident. The toe erosion at the highest stages of flood in the river must have caused the failure of the pitching on this upstream corner to begin with. Following this the rest of the pitching must also have slipped allowing the earth filling inside the retaining walls of south abutment to slip into the river. The failure of the pitching and of the filling

behind the south abutment resulted in side erosion of the approach bank to a length of 70 ft. This, in our opinion, was the primary cause of the accident.

9. (1) During the course of the enquiry, questions were raised about:—

(a) Certain features of the river, the siting of the bridge and the design of the works auxiliary to it;

(b) The wrong siting of bridge;

(c) The adequacy of design of the south abutment and its protective works;

(d) Not following up experience of the 1937 floods (which was higher than the design flood), and classifying the bridge as a vulnerable one.

(2) We have examined these points carefully. At the outset, we should like to state that the following features of the river and the bridge should be fully appreciated before any evaluation of the case can be made:—

(i) The river is a jungle stream with a comparatively small catchment, and real heavy floods are very rare and the time intervals between such floods can be very large indeed.

(ii) The floods when they arrive appear to be of a very short duration, and for the bulk of the year and in dry years the living stream is a tiny one.

(iii) There are no daily records of water levels of the river to follow the behaviour of the river from day to day.

(iv) The tendency to mix up pre-accident and post-accident experiences relating to the river and the bridge in evaluating the features of this case.

(3) Items (i) to (iii) of the above do not need any further explanation, but (iv) will be adverted to later.

(4) It has been urged before us that the peak discharge figures given by the Railway are not completely reliable and were much less than 50,000 cusecs stated by them. While we have made no independent investigation of these figures, from the several figures produced before us, we are inclined to the view that the probable peak discharge was of the order of 40,000 cusecs. It is not possible to make exact calculations because of lack of reliable records of the flood levels at the peak flows, up and down stream of the bridge.

(5) Referring to the case that the siting of the bridge was not correctly done, the bridge actually is at a place where the stream crosses the bridge at right angles and is on the straight. It is true that there are two bends upstream in the shape of a 'S' bend, but this reason alone does not preclude the bridge being sited as has been done in this case. The road bridge some 2 miles down-stream of it

has also been similarly sited. Very many considerations enter into a proper choice of site and we do not share the opinion expressed that a better site could have been chosen.

(6) A point has been raised that the scour at the south abutment leading to the breach was caused by the meeting of two streams at the upstream corner of this abutment, undermining the toe of the pitching and the revetment. This diagnosis is correct in our view, but it has been stated that action should have been taken to anticipate this before the 1956 floods and the matter has been discussed at considerable length. From the evidence available to us and the history of the bridge in para. 6, we observe that there was a shallow erosion in the south bank at a distance of about 800 ft. from the bridge, which occurred in 1937 or later and which was protected in 1944. There is no evidence to show that this erosion had been continuing or extending from year to year or a dangerous one, and nothing had occurred at this place after 1944. There had been no erosion round the south abutment or its pitching, but on the other hand evidence shows a gradual slight silting of spans 5, 6, 7 and 8 and lowering of bed in spans 1 to 4 in the course of years. There was no deep channel by the side of the south embankment from the revetted portion 800 ft. away down to the abutment. Even after the present floods, where an erosion has occurred at the site of the revetment, we do not observe a continuous channel connecting this revetment (800 ft. away) to the south abutment. A study of the plans and the course of the flood shows that there have been both parallel and angular currents widely distributed over a large area which gathered together a little ahead of the corner of the south abutment and started scouring a deep channel in close proximity and round the south abutment. The point for consideration is whether the revetment done in 1944 well away from the bridge and the south abutment could have created anticipations of erosions of a kind as would involve a danger to the south abutment. This is to be considered in the context of the absence of any trace of continuing erosion in the 12 years from 1944 to 1956 when the present flood occurred and the interval of 19 years reckoned from 1937 floods. This is the crux of the whole problem.

(7) Besides the above facts and the facts mentioned in paragraphs 5 and 6 of this report, the following additional facts have to be taken into account in evaluating this problem. The bridge at the south abutment had stood without any damage for 28 years upto the date of the accident. The type and form of construction was one generally adopted by the South Indian Railway (a Company Railway) for not only this bridge but many other bridges on this line across rivers, both big and small. None of these have given any trouble. There was no indication about a possible occurrence of floods of this magnitude or possible scours round the south abutment as have actually taken place. In approaching the question of responsibility of the Engineers in this matter, it would be relevant also to state that the criterion to be applied should be the knowledge of facts and experience gained *upto the date* of the accident and not of facts and knowledge gained *after* the accident. The two criteria should not be mixed up.

(8) If all the above facts are taken into consideration, the mere omission of this bridge from the lists of vulnerable bridges, in our opinion, has no bearing on the course of events which ultimately led to a breach in the approaches behind the south abutment and resulted in this serious train accident.

10. **Responsibility for accident**

(i) *Driver.*—The driver of the ill-fated train and his two firemen were unfortunately killed in the accident. There was no eye witness who saw the engine falling into the breach. The engine Y.P. No. 2069 was mechanically in good condition. It had its periodical overhauling from 6th November 1956 to 16th November 1956 in the Workshops and general overhauling on 19th November 1956. It worked No. 608 Up Passenger from Villupuram to Madras Egmore on 22nd November 1956 and was returning with No. 603 Down when it met with the accident. The train left Ariyalur at 5.21 hours and reached the site of accident a distance of 2½ miles from Ariyalur at 5.28 hours. He could have hardly attained the prescribed speed of 40 miles by the time he crossed the bridge No. 252. After the accident the regulator was found in the closed position, the vacuum handle was 'off'; the drift also was closed. All these indicate that the driver had full control over the engine. While the engine was passing over the bridge, the night was dark, the weather was foggy and the driver could not possibly have seen anything untoward happening behind the abutment ahead. It was only after crossing the bridge that he might have seen signs of erosion. It is possible that he tried to stop the engine by applying vacuum brake but it was too late. He and his two firemen carried out their duties in accordance with the Rules and lost their lives on account of the accident.

(ii) *Patrolman.*—(a) Shri R. Innasimuthu was the night Patrolman on duty for the beat from Mile 168 (Ariyalur) to Mile 171/6. Bridge No. 252 was within his beat. On the night of the accident, he left Ariyalur at 19.00 hours according to his schedule, arrived at Mile 171/6 at 21.00 hours exchanged sheet and returned to Ariyalur after patrolling at 23.30 hours. He re-started for the second trip at 0.30 hours, reached the end of his beat at 3.00 hours and arrived back at Ariyalur after 5.00 hours. He carried out his patrolling strictly in accordance with Special Instructions laid down in South Indian Railway General Subsidiary Rule, *vide* para. 200(d).

(b) The Patrolman is required to protect trains

(1) on noticing an obstruction or breach

(2) when the line is unsafe but not actually breached.

(c) During the course of his night patrolling he found water at the bridge site rising from 5 ft. below bottom of girder at 21.45 hours to 2 ft. below bottom of girder at 4 hours. When he left the bridge at 4 hours there was no rain and he thought that water would soon start falling and the bridge was quite safe. On reaching Ariyalur he handed his Patrol Sheet to the Assistant Station Master on duty and then went to report to the Assistant Permanent Way and Permanent Way Inspectors about water flowing in the river.

(d) By the time the Permanent Way Inspector reached the station news about the accident had been received.

(e) It might be argued that the Patrolman should have waited at the bridge and satisfied himself that water did not rise further. He did actually stop for 15 (fifteen) minutes at Trichi abutment and saw nothing unusual. With ordinary hand signal light it would have been impossible for him to observe or even guess that the abutment was being undermined.

(iii) *Permanent Way Inspector.*—(a) Duties of the Permanent Way Inspector are detailed in Chapter II and in various other Chapters in Indian Railways Way and Works Manual published by the Railway Board in 1954. The Permanent Way Inspector is directly responsible for the safety of track. On sections where the Permanent Way Inspector holds charge of both track and building works, he is responsible for inspection and maintenance of service buildings, structures, staff quarters, bridges, protective works on bridges, etc., in addition to inspection and maintenance of track.

(b) Sri T. V. Soundararajan, Permanent Way Inspector, Ariyalur, had worked as Time-Keeper for 25 years before he was promoted to the present post of Permanent Way Inspector. He did not possess any Engineering academic qualification, but according to the practice that was followed on the ex-South Indian Railway he was put in charge of Maintenance of bridges and buildings. Bridge No. 252 of the Marudayar river was in his charge. On 19th November 1956 he received a warning from "Weather, Madras" saying "Locally heavy rain likely in your area next 48 hours". On the same day he also received a message from the Station Master, Agastiampalli, stating "heavy rain and wind from 7 hours—suspect cyclone like last year". At 20.30 hours on the same day he also received a wire from his Divisional Superintendent for introducing intensive patrolling and warning all gangmen and taking necessary precautions. He trollied from Ariyalur to Sendurai on the 19th and from Sendurai to Pennadam on the 20th to alert the gangmen. As there was no rainfall on the 20th and 21st between Kallagam and Sendurai, he did not consider it necessary to alert the gangmen on this section.

(c) At about 5·30 hours on 23rd November 1956 he received a phone message from the District Traffic Superintendent, Trichinopoly, that train No. 603 Down had been stopped by the Night Patrolman on the approach bank of girder bridge No. 194 at mile 151/8-9 as the water level in Anavari Odai was rising and that the train was personally piloted by him. The Permanent Way Inspector was preparing to go to this bridge by No. 608 Down, departure 6.25 hours when at about 6.00 hours he received information about water in Marudayar river under the railway bridge. He immediately went to the station and there he learnt that No. 603 Express had met with a serious accident at the bridge. On the night of 22/23rd November 1956, there was heavy rain in the catchment area of Marudayar river and the rainfall gauge kept at Ariyalur in charge of the Permanent Way Inspector recorded a rainfall of 3·75" within 24 hours ending at 8.00 hours on 23rd November 1956. He had inspected the bridge and its protection work on 22nd and did not find anything wrong with the

protection work. He therefore did not consider any intensive patrolling necessary for this bridge, and took no further precaution as there had been little rainfall on this section from 20th till the evening of 22nd.

(iv) *Station Master.*—(a) The Station Master of the beat station of a Patrolmen's beat is required to enter in ink the actual times of departure and of arrival of the Patrolmen in the beat sheet and has to sign it.

(b) In the event of any patrolman not reporting at the time at which he is due, the Station Master has to warn the nearest Permanent Way Inspector and Sub-Inspector by wire and send a written message to the nearest Gang Maistry instructing him to proceed along the line to ascertain the cause of the absence of patrolman and to arrange for a substitute.

(c) He is also required to issue caution order to Drivers to observe special caution and reduce speed as necessary.

(d) Sri Vincent Raj, Relieving Assistant Station Master, was on duty at Ariyalur station from 21-30 to 6-00 hrs. on 22nd/23rd November 1956. Train No. 603 Tuticorin Express arrived at Ariyalur at 5.18 hrs. and left at 5.21 hrs. The train should have reached Kallagam at about 5.40 hrs., but no arrival report was received from that station. At 5.50 hrs. he tried to call the attention of Station Master, Kallagam, but there was no response. He tried to inform the Controller on the Control phone, but got no answer from him. He even tried Morse, but the telegraph line also was not working. He ordered a Pointsman to proceed towards Kallagam to find out what had happened to the train. By then the next Assistant Station Master on duty, Sri Vasudevan had come to the station, and he was told of what had happened. The Station Master was called for. In the meantime, at about 6.25 hrs. a local villager came and informed them that the train had fallen into the river. Soon after two passengers from the illfated train came running and informed them that 7 bogies had fallen into the river and the rest were on the rails. No. 699 Passenger train was there at the station, and its engine and one bogie were detached. The Permanent Way Inspector with men and material and First Aid boxes took the engine and bogie to the site of the accident. The night patrolman on duty for the beat at mile 171/6 stated before the Government Inspector that he arrived at Ariyalur station at 5.30 hrs. and informed the Station Master that there was nothing wrong with the track. It might be argued that as the train left at 5.21 hours, the Assistant Station Master on duty should have issued a Caution Order to the driver since the patrolman had not arrived at the time when he was due. The time of arrival of the patrolman as recorded by the Assistant Station Master in the beat sheet is however 5.00 hrs. Apparently the time has not been entered correctly. The patrolman must have arrived later. When re-examined the patrolman stated that when he arrived at the station the train was still standing on the platform. Apparently the time recorded was the scheduled time of arrival and the Assistant Station Master did not take the trouble of recording the exact time of patrolman's arrival at the station.

11. After careful examination of all the material made available to us in this case, we are of the opinion that no individual person can be held responsible for this unfortunate accident. This is however not to say that there have been no minor lapses here and there but they have no significance on the main issues arising for consideration in this case.

12. **Safeguards against similar accidents in future**

(i) General Rules for Railways and Subsidiary Rules applicable to individual Railways contain safeguards for the safety of travelling public. The accident to train No. 603 Down on 23rd November 1956 near Ariyalur was caused by heavy floods undermining the south abutment and eroding the approach bank of the Railway line involved in the accident. Rules regarding inspection of Bridges are detailed in Chapter X of Indian Railway Way & Works Manual, published by the Railway Board in 1954, Chapter XI of this book deals with Rivers and Floods, Chapter XIV with Breaches and Pre-Monsoon Precautionary Measures and Chapter XVII with Patrolling of the Railway line during Monsoon or in times of Emergency.

(ii) Subsequent to this, the Railway Board issued further detailed instructions in regard to inspection of bridges, *vide* their letter No. 54/W/10/31, dated 2nd December 1954 and letter of even No. dated 3rd September 1955. If these instructions are strictly followed by all concerned, they provide adequate safeguards against accidents during floods. It might, however, be pointed out that when it was published it was envisaged that the practices followed on some Railways might differ in important details from those prescribed in this Manual. This accounts for non-implementation of certain rules now laid down on lines which were formerly managed by *ex*-Company, like South Indian. To take a concrete example, Para. 1702 reads as follows:—

> "*Gang-patrol during abnormal rainfall.*—In the event of a sudden severe storm in the day or night, the Mate should, on his own initiative, organise patrolling over the length affected independent of other patrolling if any being done; this patrol should confine its inspection to known points of danger such as cuttings or culverts likely to scour, banks affected by tanks likely to breach and bridge approaches."

On *ex*-S.I. Railway no Railway quarters were provided for Gangmen either at stations or between stations in their beat to enable the Gangmen to turn out at night in case of emergency for patrolling the line. It was presumably for this reason that night patrolling was resorted to on this Railway practically on sections where floods were common. Out of various suggestions that have been put forward by several people in this Enquiry, we recommend that the following be considered further and implemented if found expedient:—

(a) Duties of patrollers, in respect of signs of danger to be looked for during the monsoon [such as heading up of water on upstream side of bank (afflux) water level upto

or within two feet of formation, high velocity through bridges, settlement of track, water touching the girders and eddy currents behind wing and return walls or around piers and abutments] should be clearly laid down. Engineers and Inspectors may be instructed to explain them to the staff before and during the monsoon each year.

(b) On sections where Railway quarters are not provided to them, at least 2 patrollers should be appointed for each beat, both of them experienced Gangmen specially trained for the purpose.

(c) In case of doubt, patrollers should not allow trains to pass over bridges when river is flowing at high velocity.

(d) The length of beat of patrollers should not exceed more than three miles.

(e) Night patrolmen should have with them torches instead of hurricane lantern to enable them to observe the height of water and the strength of current flowing through the bridges or along the abutments.

(f) Patrollers should be trained how to take soundings, probings near abutments and piers to determine the depth of scour in order to decide whether trains should be slowed down or stopped and pilotted over the danger point, and the selection of men for this work should be from people who can usefully function in this manner.

(g) Stationary watchmen be posted and sign boards put up at either end of the bridges wherever considered necessary.

Other suggestions

(h) Daily water readings should be taken at all important bridges during the monsoon and the register should be available for perusal by the superior Engineering staff, at any time. The staff should be properly trained for this purpose.

(i) The rules in Chapters X and XI in Works Manual should be amplified to include an appendix on river training and control of big and small rivers and indications to be looked for for future trouble clearly described and explained. It is suggested that Railway Assistant Engineers and District Engineers should undergo a short course on this and also visit river model research stations to acquaint themselves with the behaviour of rivers and their response to training works.

(j) The High Flood Level mark should be prominently marked on every bridge and a danger level mark below High Flood Level should be fixed by the Engineering authority and marked in *red*. When this level is exceeded, the patrolman should be prepared to stop trains and pilot them if necessary.

(k) Passenger trains should carry portable telephone instruments so that they can communicate with the nearest Railway stations in the event of trains being halted between stations by patrolmen.

A. R. VENKATACHARI. P. C. KHANNA.

MADRAS;
30*th December* 1956.

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